Statens haverikommission

Avalanche accident in connection with heli-skiing activities near Abisko

The Swedish Accident Investigation Authority has investigated an avalanche accident in Kårsavagge, Norrbotten County, 20 March 2025

27 May 2026

Slutrapport
SHK 2026:07e

About Swedish Accident Investigation Authority

The Swedish Accident Investigation Authority (SHK) investigates accidents and incidents from a safety perspective regardless of whether they occurred on land, at sea or in the air. The authority's accident investigations are intended to disseminate knowledge and provide a basis for actions by authorities, companies, organisations and individuals that improve safety and reduce the risk of accidents. The activities should also contribute to people feeling secure and having trust in society's institutions and the confidence in transportation systems. The mission also includes assessing the efforts made by the rescue services in connection with an accident. However, the investigations should not assign blame or liability, whether criminally, civilly, or administratively.

The investigations by SHK aim to answer three questions:

- What happened?
- Why did it happen?
- How can a similar accident/incident be avoided in the future?

The report is also available on the Swedish Accident Investigation Authority's website: www.shk.se.

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Summary

On 20 March, 2025, an avalanche accident occurred during a guided heli-skiing tour in the Kårsavagge valley. Seven persons were involved in the accident: a mountain guide, a helicopter pilot and five paying guests.

During the day, the group had completed several runs in the Abisko area, when the guide and four of the guests set out for a last run. During the run, an avalanche of the *persistent slab* type was triggered.

Two of the skiers were buried in the avalanche and died. The guide, who was further down than the guests, was caught in the avalanche and was injured. The pilot, who was in the helicopter, also sustained injuries. The helicopter, which was parked below the slope, was hit by the avalanche and its tail boom was damaged.

Extensive rescue operations were carried out. The community's ability to carry out rescue services was hampered by difficult terrain, poor weather conditions and the involvement of numerous actors, which made the operation complex and challenging to coordinate. The investigation shows that there is a need to strengthen command capabilities during mountain rescue operations.

Causes of the accident

During guided skiing in unprepared terrain, an avalanche of the type persistent slab was triggered and the following interacting factors contributed to the accident:

- The skiing was carried out adjacent to and inside of, avalanche terrain.
- Parts of the group ended up in an area from which the avalanche could be triggered.
- The skiers had not received detailed information on how the descent should be carried out.
- The guide presumed that the skiers would follow his tracks.
- Avalanche problems of the persistent slab type are difficult to identify.
- A false sense of security led to the risks being underestimated.

Since the guide was caught in the avalanche, he was unable to immediately lead and coordinate the companion rescue, which delayed the location of the missing persons.

Safety recommendations

Niehku Adventure AB is recommended to:

- strengthen risk communication to guests in order to increase the understanding of how guided skiing in unprepared terrain should be carried out safely (see section 3.3.1) *(SHK 2026:07 R1)*

The Swedish Mountain Guide Association (SBO) is recommended to:

- within the scope of its work, highlight the accident with particular emphasis on the importance of clear and needs-adapted risk communication (see section 3.3.1) *(SHK 202607 R2)*

The Swedish Work Environment Authority is recommended to:

- investigate the need to clarify the requirements for first aid equipment for activities involving particular risks, which are conducted in extremely remote areas (see section 3.6.2) *(SHK 2026:07 R3)*

The Swedish Police Authority is recommended to:

- clarify its methodological guidelines to ensure that assigned equipment, such as defibrillators and identification, is brought to the accident site (see section 3.7.2) *(SHK 2026:07 R4)*

- review the possibility of strengthening command capabilities during complex operations in mountain environments (see section 3.7.3) *(SHK 20*26:07 *R5)*

- strengthen its efforts regarding radio discipline and the application of pre-planned communication plans during mountain rescue operations involving multiple actors (see section 3.7.3) *(SHK 2026:07 R6)*

The Swedish Civil Defence and Resilience Agency is recommended to:

- ensure, in the development of Rakel G2, that critical societal actors are able communicate in extremely remote areas (see section 3.7.3) *(SHK 20*26:07 *R7)*

SOS Alarm Sverige AB is recommended to:

- review its procedures for following up on alarm plans to ensure that the correct resources reach the accident site (see section 3.7.1) *(SHK 20*26:07 *R8)*

The investigation

SHK was informed on 20 March 2025 that an avalanche accident had occured in Kårsavagge, approximately 8 km west of Abisko, Norrbotten County, around 15:50 on the same day.

The accident has been investigated by SHK represented by Kristina Börjevik Kovaniemi, Chairperson, Kristoffer Danèl, Investigator in Charge, Mats Trense, Operations Investigator, Eva-Lotta Högberg, Operations Investigator until 10 October 2025, Sofia Martinsson, Fire and Rescue Service Investigator, from 18 August 2025 and Marit Lindberg, Medical Investigator.

SHK was assisted by Helge Brändström, medical expert and by avalanche experts from the Swedish Environmental Protection Agency.

The investigation was followed by: Petter Palmgren from the Swedish Environmental Protection Agency, Anna-Carin Widmark from the Swedish Consumer Agency and Samuel Koelega from the Swedish Civil Defence and Resilience Agency (formerly the Swedish Civil Contingencies Agency).

Investigation material

SHK has conducted interviews with the organiser of the helicopter skiing, the guide, the pilot, the surviving guests, as well as the helicopter operator. In addition, interviews have been conducted with the Swedish Mountain Guide Association (SBO), the Canadian organisation HeliCat[1], other helicopter skiing operators in the area, as well as their guides and pilots.

Information has been collected regarding regulations, supervision, inspections, similar incidents, mountain guide training and weather conditions.

Interviews have been conducted with the incident site officer from the mountain rescue service, as well as the chief fire officer and the incident site officer from the Kiruna municipal fire and rescue service.

With regard to the medical response, interviews have been conducted with medical personnel who worked at the accident site and physicians at the University Hospital in Tromsø.

SHK has obtained position data from the helicopter operator and from one of the skiers' smart watches, which recorded time and position via GNSS[2]. Based on this information, the skiers' speed has been calculated.

SHK has also obtained information from the Police Authority and the Swedish Environmental Protection Agency. Weather data and analyses have, where nothing else is stated, been obtained from the Swedish Meteorological and Hydrological Institute, SMHI.

[1] HeliCat Canada – A Canadian industry organisation that establishes and monitors standards for safety, operations and environmental considerations within heli-skiing.

[2] GNSS (Global Navigation Satellite System) – A collective term for satellite-based navigation systems such as GPS, Galileo and GLONASS.

SHK contucted an accident site investigation 22 March 2025. The site was documented using drones, cameras and GNSS equipment. Tracks and positions were recorded. The work has, among other things, aimed to determine the ski tracks of those involved, tracks from the companion rescue, the position and depth of the victims in the avalanche, the size and extent of the avalanche, as well as the topography and slope of the relevant areas. Images and videos from 21 March, obtained from the Police and the mountain rescue service, have also been used.

A fact-finding presentation meeting with the interested parties was held in Kiruna on 20 October 2025 and in Novara, Italy, on 13 November 2025. At the meetings SHK presented the facts discovered during the investigation, available at that time.

Final Report SHK 2026:07e

Operation	
Class	Guided heli-skiing in off-piste conditions
Organiser	Niehku Adventure AB
Time of incident	20 March, 2025, at 15:47 in daylight
Location	Kårsavagge, Norrbotten County Position 68°20'37"N 18°37'43"E
Weather	According to SMHI’s analysis: Partly cloudy, north-westerly wind approximately 10 m/s, -5 °C During the rescue operation, the weather deteriorated and snowfall moved into the area.
Injuries	Two fatalities, two injured
Material damage	Damage to a helicopter – tail boom attachment
The guide, competence, certificates	Certified mountain guide according to the international standard for mountain guides – International Federation of Mountain Guide Associations (IFMGA)

1. Factual information

1.1 Sequence of events

1.1.1 Preconditions

This section provides a brief description of the area, the organizer, the skiers and the conditions prior to the accident. This is followed by a description of the sequence of events and the companion rescue. More detailed information can be found in specific sections later in the report.

In the report, the terms “participants,” “guests,” and “skiers” are used synonymously to describe the individuals who took part in the guided skiing, unless otherwise specified.

The description of the sequence of events is based on GNSS data from the helicopter used during the heli-skiing, data from one of the skier’s smart watches, analyses of photographs of ski tracks, as well as an overall assessment of information from those involved. If the information differs, the various perspectives are presented.

The sequence of events is illustrated, among other things, with satellite images of the area taken in April 2020. Although some changes in vegetation may have occurred since then, the growth process is slow. Therefore, the satellite images are considered to provide a representtative picture of the vegetation at the time of the accident.

The area

The area where the accident occurred is located in a very sparsely populated part of northernmost Sweden, see figure 1. In the Riksgränsen/Abisko area, there were four permanent helicopter skiing operators during the year in question, as well as an additional one to three seasonal operators. The area used covers approximately 25,000 km² and is largely devoid of a road network.

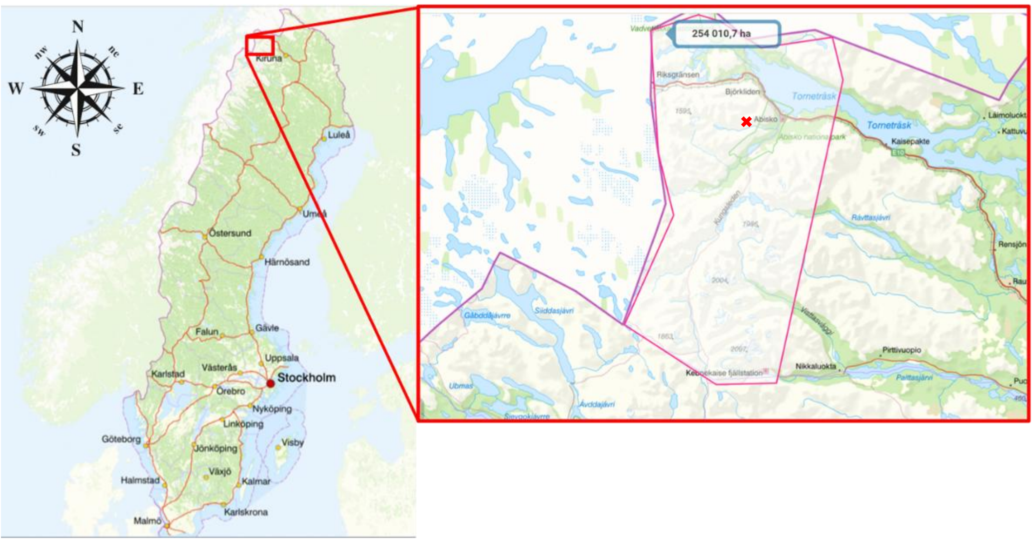

Figure 1. The area in question is enlarged in the box to the right. The accident site is marked with a cross. Source: Lantmäteriet (the Swedish mapping, cadastral and land registration authority). Markings added by SHK.

The weather in Riksgränsen and Abisko during the month of March had initially been stable high-pressure conditions with severe cold. However, following a storm with gale-force gusts on 8 March, it shifted to intermittently windy and significantly milder weather, with periods of snow showers. On 14 March, the weather in the area deteriorated further, with strong west-north-westerly winds and snowfall.

Organiser and guests

Niehku Adventure AB (hereinafter referred to as Niehku) organised various types of alpine activities, including heli-skiing. The business started in 2018 and was based at Niehku's Mountain Villa (hereinafter referred to as the hotel) in Riksgränsen. For heli-skiing, guides were contracted as self-employed individuals, as well as a contracted helicopter company, Kallax Flyg AB.

The heli-skiing season started on 10 March, 2025. It normally ends in May. The guide arrived in Riksgränsen on 8 March, 2025, to begin the season.

The five guests, a Swiss/Italian family, arrived at the hotel on the evening of 16 March and were to stay until 20 March. All were experienced skiers and had experience in high alpine terrain. When booking, they had stated that all had experience with heli-skiing and that they were at an expert level regarding off-pist skiing. None of the guests had previous experience of the Swedish mountains.

Conditions prior to the accident

The day after the guests' arrival, on 17 March, a safety briefing was held. Avalanche equipment was distributed and a transceiver[3] search exercise was carried out. The exercise involved locating pre-placed transceivers. These had transmit signals that could be activated by an operator. The devices were placed in buried boxes and the distance from the starting point to the boxes was about 40 metres. During the exercise, one box/sending transceiver was activated. At this time, the guide made an initial assessment of the guests' competence and skill in handling the equipment and of how they performed the exercise.

During the period from 17 to 19 March, the weather was too unfavorable for heli-skiing. Instead, the guests took part in guided ski touring and lift-accessed skiing in the Riksgränsen ski area. During these occasions, the guide assessed how the group functioned in off-piste terrain as well as their familiarity with the equipment.

For the forecast area Abisko/Riksgränsen, on 19 and 20 March, the avalanche danger forecast was at level 3 out of 5. For 20 March, it was specified that the avalanche problem consisted of wind-drifted snow slabs on the open mountain and steeper slopes in a continuous sector from north through east to south.

[3] Transceiver, is an electronic device used in avalanche safety to transmit and receive radio signals, enabling individuals buried in an avalanche to be located by others in the group.

1.1.2 Sequence of events

On 20 March, there was a local improvement of the weather and the pilot assessed that it was safe to fly. In the morning, the helicopter was prepared and the pilot conducted a short test flight at 08:40. The guests were informed that heli-skiing might be possible and at 09:27 the helicopter took off with the guide and the guests.

The conditions were considered inadequate for helicopter operations in all areas except the Abisko area. This area is often chosen because weather conditions there are generally more stable and predictable than in other parts of the operating area. The area that was subsequently assessed as skiable, where helicopter operations could be conducted safely and where the skiing was then mainly carried out, was located in the eastern part of the Kårsavagge valley.

The group skied in the Kårsavagge valley during the morning. At lunchtime, they returned to the hotel for a break.

After the lunch break, the pilot made a new assessment of the weather and visibility conditions. These were deemed sufficiently good to continue flying in the afternoon as well. Around 1 p.m., the weather was partly cloudy with some haze.

The afternoon session began at 13:50 and skiing continued in the Kårsavagge valley; the area is marked in figure 2.

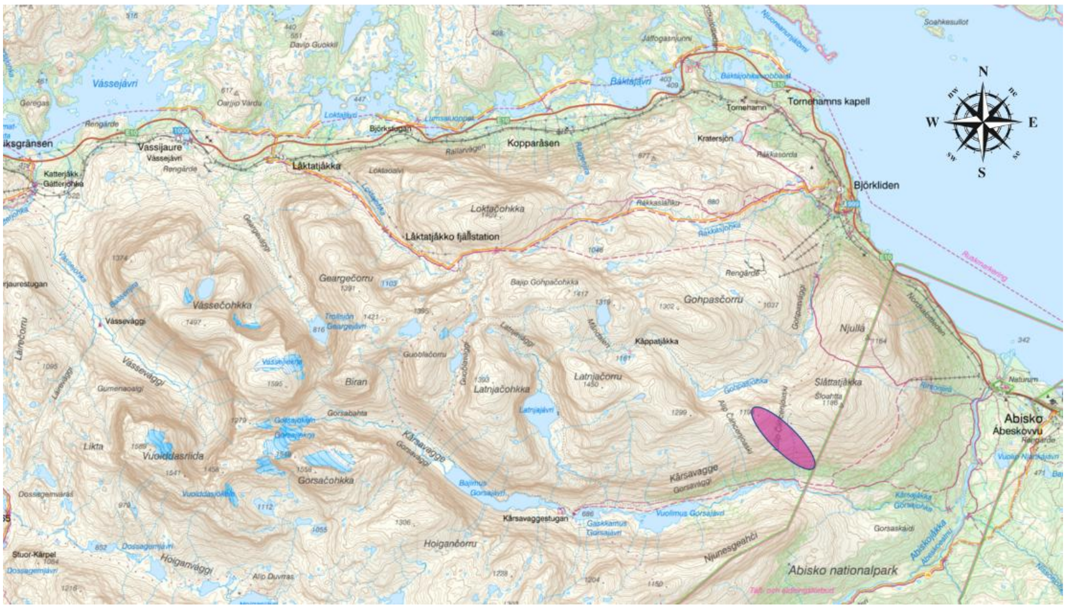

Figure 2. Topographic map; the area where heli-skiing was carried out in the afternoon is marked in purple. Source: Lantmäteriet. Markings added by SHK.

The weather cleared somewhat during the day, but strong winds persisted and visibility was intermittently reduced.

Figure 3 shows the tracks of the descents that were carried out after the lunch break, in the afternoon, prior to the accident. The figure also shows the helicopter's flight paths between the valley and the summit. The vertical drop of the runs was approximately 400 metres.

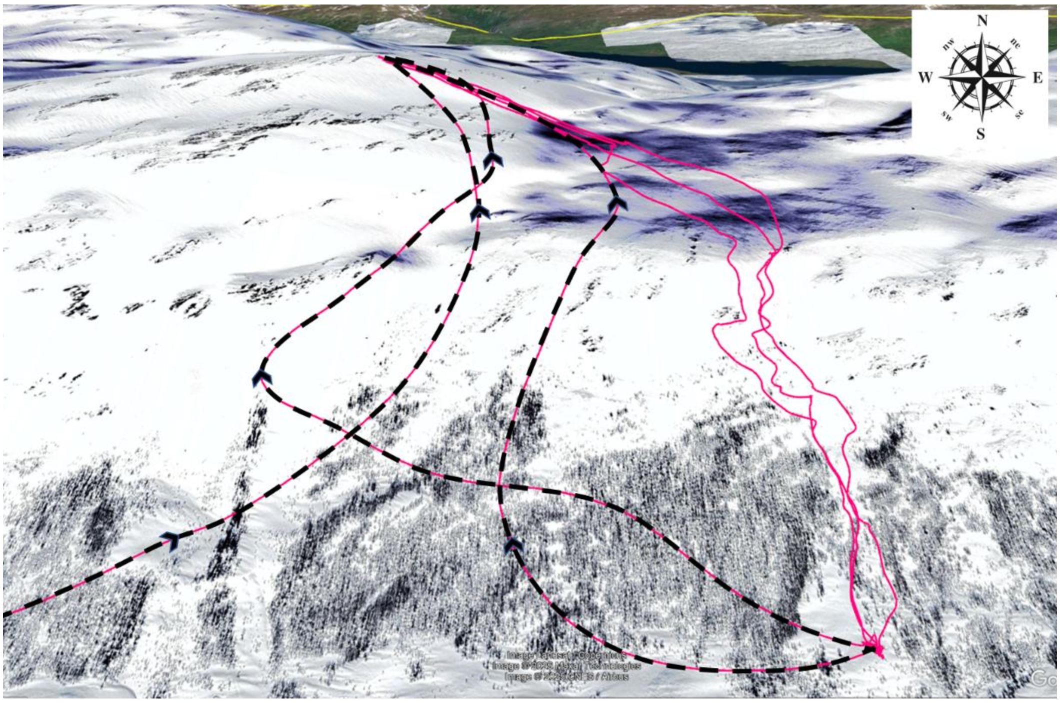

Figure 3. Satellite image of the ski area. The image includes GNSS tracks from one of the skiers from the three afternoon runs, shown as solid pink lines. The black and pink lines indicate the helicopter lifts.
Source: Google Earth, image date 2020-04-28. Markings added by SHK.

At 15:25, the skiers had completed three runs in the same area. The skiers discussed whether to do another run and expressed a wish to ski in an area where the snow was still untouched. The guide therefore decided that they would do one last run before returning to the hotel. In making this decision, it was taken into account that there was enough time to complete the run with a margin before darkness fell and to return to Riksgränsen in time for a taxi which was scheduled to pick up the guests at 16:30 for transport to Kiruna.

During the previous helicopter lifts, the guide carried out reconnaissance regarding possibilities for other descents westerly of the most recent runs. For the final run, a new line in this area was chosen and a more detailed reconnaissance was conducted; see figure 4. Here too, the terrain was gentle, but it bordered a steeper mountainside where larger amounts of snow had accumulated over the past few days.

Figure 4. Satellite image of the skiing area and GNSS tracks of helicopter lifts and scouting before the final run (black-pink dashed line). Source: Google Earth, image date 2020-04-28. Markings added by SHK.

The helicopter flew the skiers to the top, where they landed at 15:35, at almost the same place as before. One of the guests chose to skip the final run and remained in the helicopter. The helicopter left the summit and the pilot looked for a suitable landing spot. The helicopter was parked on an almost snow-free, elevated area about 270 metres west of the planned line for the final run; see figure 6. The helicopter stood firmly, with the tail boom extending above a steeper slope. The pilot shut down the engine and went out to get a coffee break hamper before sitting down in the passenger seat.

The area of the final run

The area where the avalanche was triggered and where the accident occurred consists of a south and south-east-facing slope of approximately 500 by 500 metres; see, figure 5.

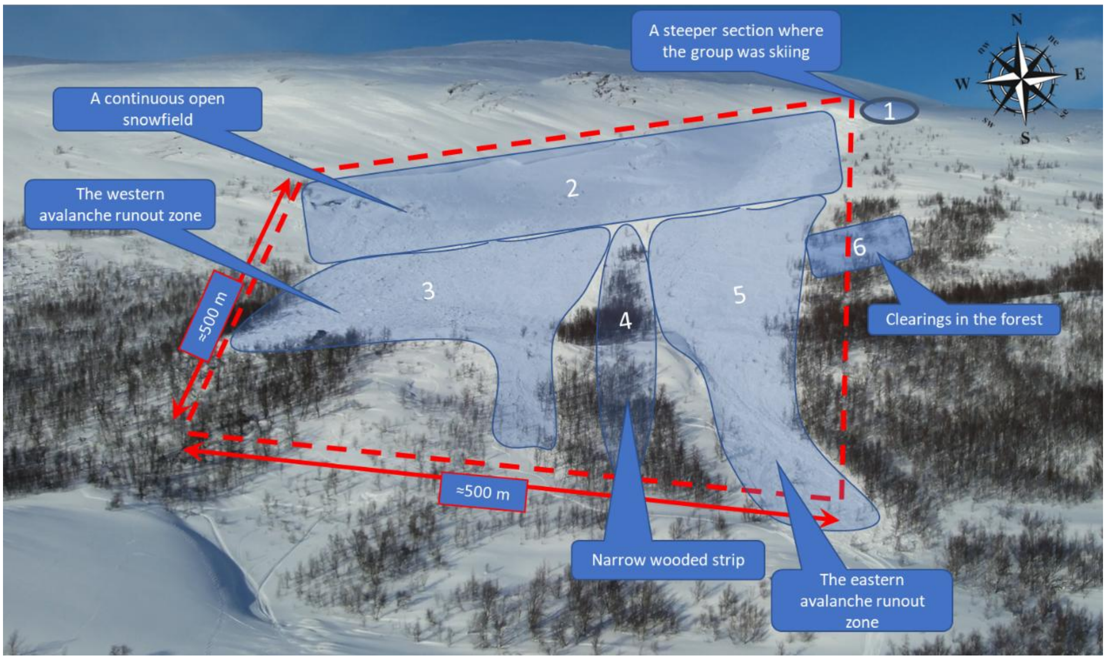

Figure 5. Avalanche area. The red dashed line indicates the approximate extent of the avalanche.
Photo: Police Authority (2025-03-21). Markings added by SHK.

In the north-eastern corner at the top, there was a smaller area with a steeper section (area 1). Connected to this there was a larger continuous snowfield that extended westward (area 2). The upper part of this snowfield had an inclination above 30 degrees. Below the tree line, the snowfield split into two parts, separated by a long, narrow wooded strip (area 4). This long, narrow strip of forest extended along the fall line and was located between two larger snowfields (areas 3 and 5). These snowfields are runout zones from previous avalanches, so-called avalanche paths. In the forested area to the east of area 5, the inclination was lower than 30 degrees and there were also two open areas/glades (area 6).

The final run

In the continued description of the sequence of events, the skiers are identified according to the order in which they descended as follows:

- Skier 1 – the guide on skis
- Skier 2 – skier on snowboard
- Skier 3 – skier on skis (deceased)
- Skier 4 – skier on skis (deceased)
- Skier 5 – skier on skis
- Skier 6 – remained in the helicopter

From the summit, the descent began with the guide going first, followed by the other skiers. The descent started in the same area as before. A short way down, the guide gathered the group and informed them that the descent would continue in a different location. This gathering took place shortly before 15:43. From here, the guide continued the descent, followed by the skiers in the previously established order.

Skiers 4 and 5 lingered for a while before following the guide's tracks westward through gentle terrain towards a steeper and more convex section; see figure 6. The convex shape meant that forward visibility was impaired until the skiers reached the steep slope.

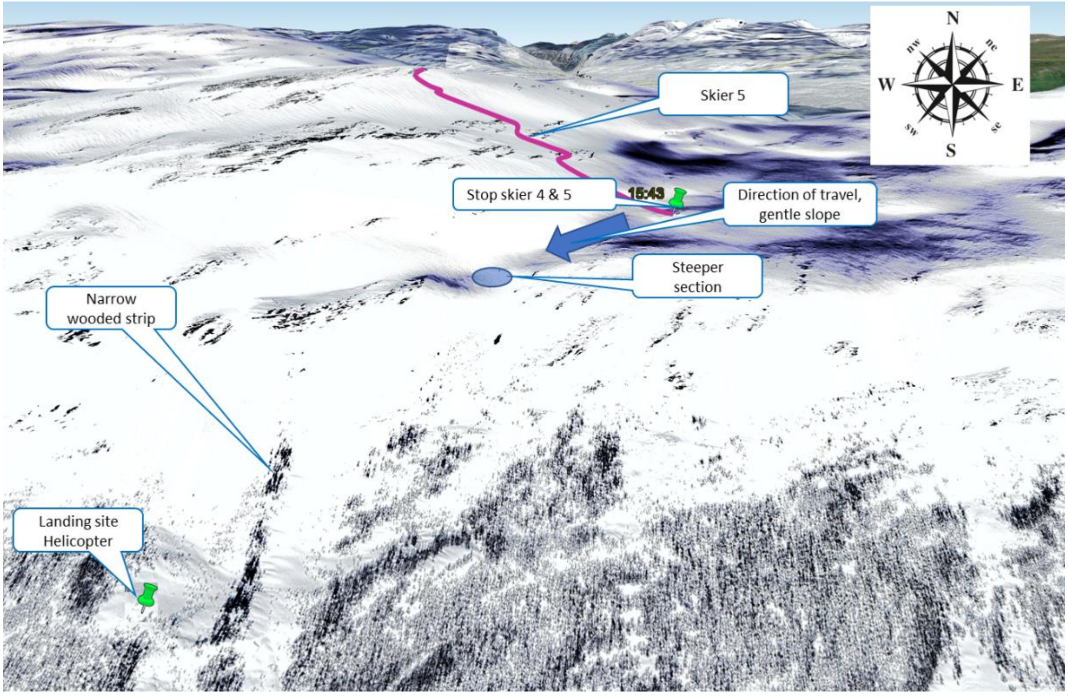

Figure 6. Satellite image of the skiing area and GNSS track from skier 5 (solid pink line). The image also shows the skiers' positions, the time of the stop, the direction of skiing and the location where the helicopter was parked. Source: Google Earth, image date 2020-04-28. Markings added by SHK.

The positions of the skiers at the steep slope have been reconstructed, see Figure 7[4]. The guide's track (marked in pink) is the one that starts furthest to the east.

[4] The tracks and positions of the skiers have been reconstructed through analyses of GNSS data, photos of the tracks and a collected assessment of witness statements, used together with documentation from the accident side.

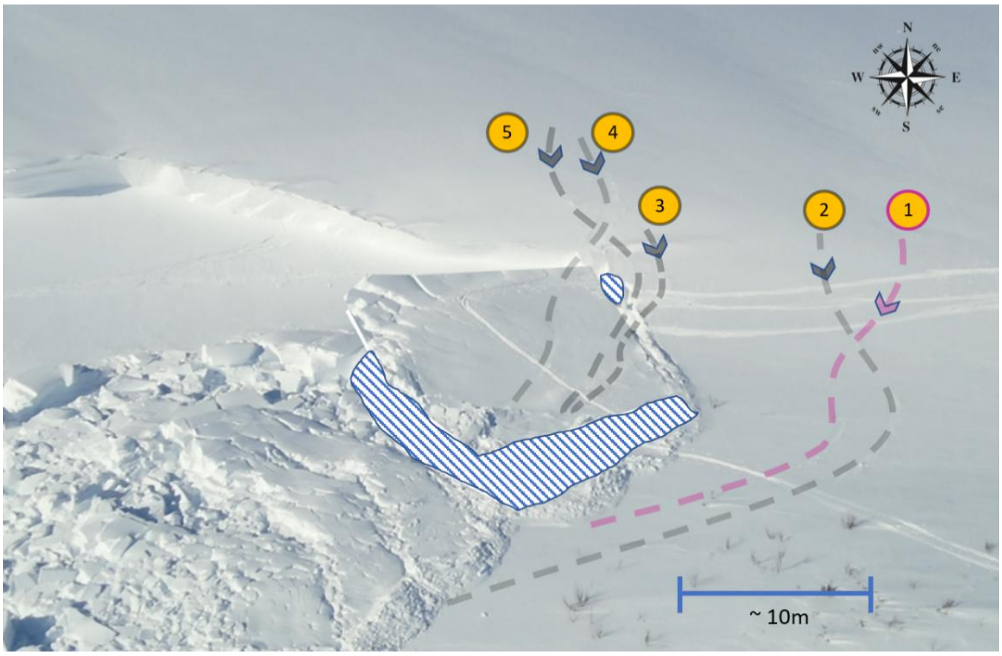

Figure 7. The skiers' tracks near the steeper section. Note that the skiers were not in these tracks simultaneously; first came the guide – the orange circle numbered 1, thereafter skier 2, etc. The dashed grey lines are the skiers' tracks. The dashed pink line shows the guide's track. The distance between the tracks of skier 2 and skier 3 is approximately 15 metres. The image has been edited; the blue dashed area indicates removed/relocated image data. The editing was done to provide a comprehensive view of the skiers' tracks. Photo: Police Authority (2025-03-21). Markings added by SHK.

The guide has stated that, before heading out into the steeper section, he stopped and turned around to make sure that the skiers were following his tracks. He then continued and pressed down on a snow drift with his skis to check the snow stability. No snow release was observed. After the steeper section, the guide turned left (east) and followed his scouted and planned line to a larger snowfield (area 5 in figure 5). The left turn was part of the guide's planned route and meant that the descent was directed away from the open avalanche terrain, which was to the west of his tracks. The guide passed the snowfield and continued over to the long, narrow strip of forest. The guide's reconstructed line is shown in figure 8.

Figure 8. The guide's reconstructed line (pink line). The image was taken with a drone two days after the accident.

Skier 2 initially followed the guide's track into the forest but then lost sight of it. She turned right through a clearing between the trees in order to maintain a higher line and avoid losing speed and elevation towards the helicopter.

After the guide and skier 2, it was skier 3 who proceeded out onto the steeper section. The exact line of descent taken by skier 3 has not been possible to reconstruct.

Skiers 4 and 5 proceeded together towards the steeper section. They then spotted the helicopter down to the right in the direction of travel and slowed down. After that, skier 4 continued over the steeper slope, at which point skier 5 lost sight of him; the time was then 15:46. Skier 5 could also no longer see the guide, skier 2, or skier 3. Skier 4's exact line after the steeper section has not been possible to reconstruct[5].

Skier 5 went out over the steeper section and then turned right (west) towards the helicopter. When he had come a bit below the steep slope, he saw the snowpack below and around him break apart. He realised it was an avalanche and immediately turned sharply to the left (east), activated his avalanche backpack and skied as fast as he could to the left. The moment of the sharp left turn and the start of the avalanche has been determined to be at 15:47. Figure 9 shows the skiers' positions and the areas where they were likely located just before the avalanche started.

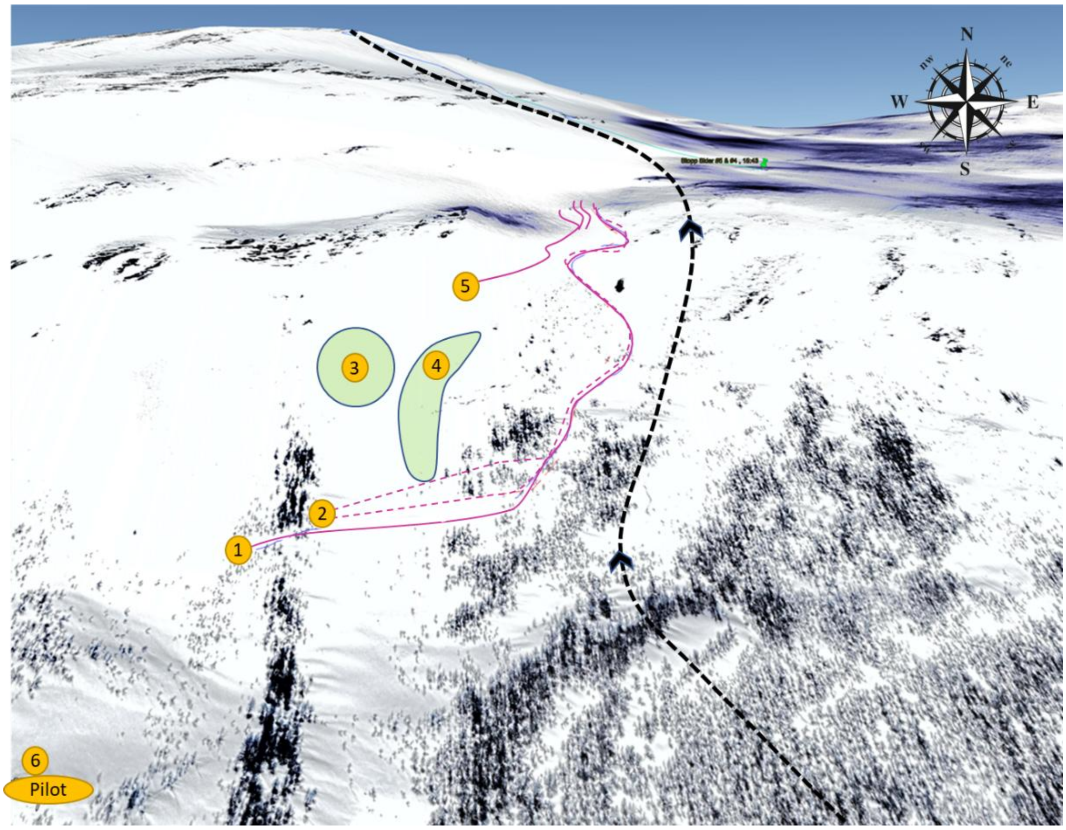

Figure 9. Reconstructed positions and tracks of those involved just before the avalanche started. On the right side of the image, the last scouting flight (i.e., the helicopter flight) to the summit is shown with a black dashed line. For skier 2, two possible route choices through the forest are shown. The probable line of descent of skier 2 is marked with a pink dashed line. Source: Google Earth, image date 2020-04-28. Markings added by SHK.

[5] The areas where skiers 3 and 4 are believed to have been just before the avalanche have been delineated based on witness statements, photos of the avalanche, analyses of the movement pattern of the uppermost snow layer and the locations where they were found.

The inclinations in the area are shown in figure 10. Here it can be seen that to the left of the helicopter's reconnaissance flight, there is a large, continuous area with an inclination of up to 40 degrees. The figure also shows the inclinations at the locations where previous runs had been carried out.

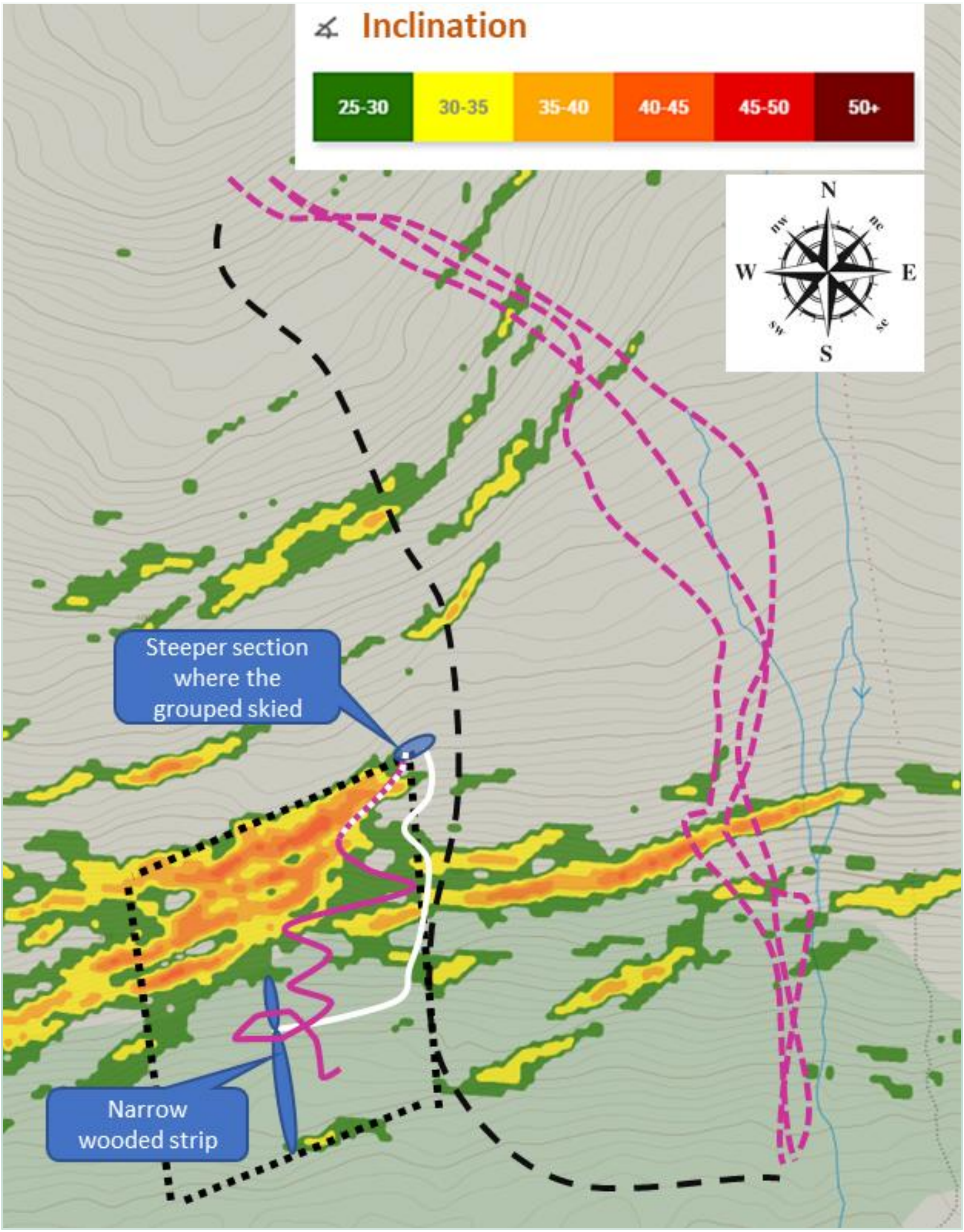

Figure 10. Inclinations map with GNSS tracks from skier 5's descent. Pink dashed line: the three runs before the final run. White-pink dashed line: the final run up to the position at the moment the avalanche was triggered. Solid pink line: the track after the avalanche was triggered. Solid white line: the guide's track. Black dashed line: the helicopter flight and scouting before the final run. Source: Swedish Environmental Protection Agency (Naturvårdsverket). Markings added by SHK.

The guide's reconstructed track initially runs mainly outside avalanche terrain. During the traverse towards the helicopter, the reconstructed track passes through a runout zone.

The avalanche

The avalanche extended approximately 430 metres westward from the steeper section where the skiers had recently passed. Further down, the avalanche split into two parts – a western and an eastern avalanche cone – separated by the long, narrow wooded strip.

When skier 5, who had turned left (east), had moved outside the avalanche cone, he stopped and then turned back to assess the extent of the avalanche.

The guide, who had made his way through the long, narrow wooded strip and was heading towards the helicopter when the avalanche was triggered, was hit by the snow from the avalanche. He described that the snow came very suddenly and the force was violent. When he was swept away by the avalanche, he collided with several trees and was unable to activate the airbag in his avalanche backpack. At the end of the slide, the guide was washed up onto the surface of the snow. When the avalanche stopped, he had ended up on a slope far down in the western avalanche cone.

Skier 2 was at the eastern edge of the long, narrow wooded strip when the avalanche was triggered. When the snow masses came, she instinctively grabbed hold of a mountain birch and managed to hold on until the avalanche stopped. She felt shaken but was otherwise uninjured and managed to detach her snowboard.

At the time of the avalanche, skier 6 and the pilot were in the helicopter. They heard a muffled roar and saw the snow masses coming towards the helicopter. The helicopter, which was on a snow-free elevation, was hit from the front and underneath by the snow. It was lifted and moved backward. The movement was so violent that the pilot, who was sitting in the front passenger seat, was thrown around in the cabin and, among other things, was hit in the face. Skier 6, who was sitting in the rear passenger seat, was not injured.

When the snow had stopped, the passenger doors were blocked. The pilot ensured that skier 6 was unharmed and they thereafter exited together through the pilot's door. At 15:51, the pilot alerted the person in charge at Niehku and then called the emergency number 112. The call to emergency services was cut off, but contact was re-established at 16:07.

Skiers 3 and 4 were missing.

Figure 11 shows an image of the entire avalanche area.

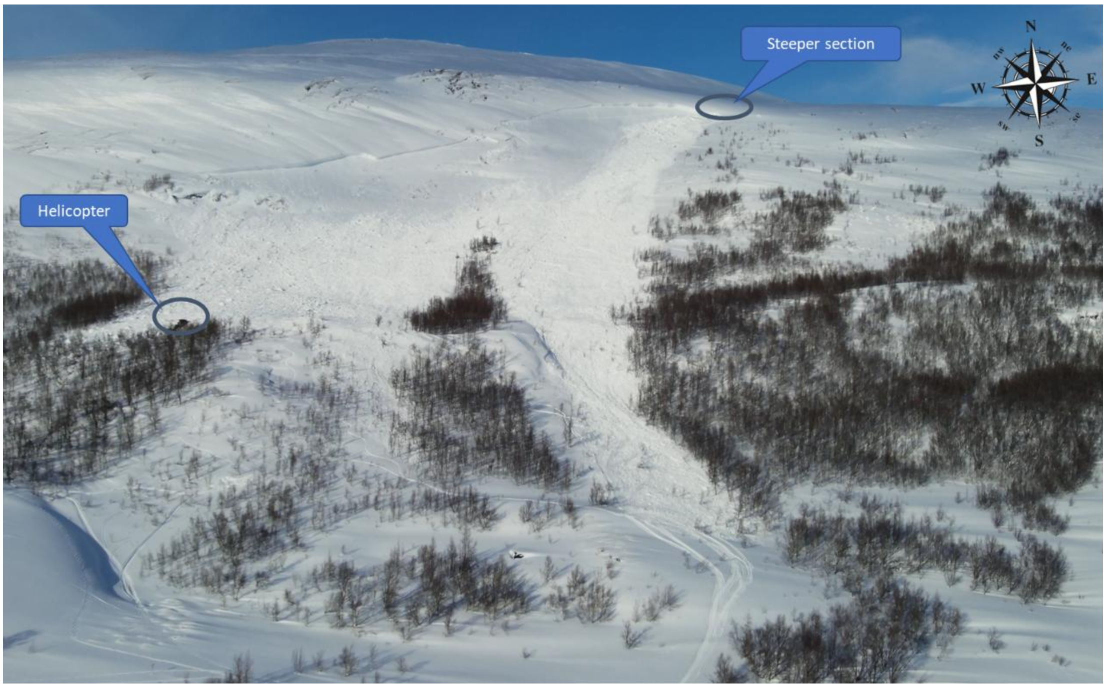

Figure 11. The area as it appeared the day after the avalanche. Photo: Swedish Police Authority. Markings added by SHK.

The companion rescue

After skier 5 had made his way a few metres into the avalanche cone, he could neither see nor hear any of the other skiers. He set his transceiver to search mode and began searching for the others at 15:49. The search started across the eastern part of the avalanche cone in a zigzag pattern covering the entire width of the avalanche cone (between 50 and 70 metres), but he received no signal.

Skier 2 moved downward along the eastern edge of the narrow, wooded strip. Further down, she converged with skier 5. Skier 2 had briefly received a signal with her transceiver, but it had now disappeared. They therefore decided that skier 5 would continue searching on the western side of the narrow, wooded strip, while skier 2 continued downward.

Skier 6 called out for the others but received no response. She then switched her transceiver to search mode, but did not pick up any signal from the other skiers. The pilot did not have an avalanche probe[6] or transceiver, but retrieved a shovel from the helicopter. Together, they began searching the western area and moved up the mountain to the east, towards the location where skier 6 had seen skier 3 just before the avalanche started.

When the avalanche stopped, the guide was buried relatively shallowly. He freed himself and got up, set his transceiver to search mode and began moving on foot straight up the slope. He was bleeding from his head and was in pain, especially in one knee and had difficulty moving. No signal could be detected from the other skiers. After making his way up a first, steeper section, he was able to detect signals and directions – upwards and to the east. The guide saw the pilot and skier 6 approaching from the west and called out for them to search on the other side (east side) of the narrow, wooded strip. Skier 6 received a signal when she came closer to the wooded strip.

[6] An avalanche probe is a long, collapsible rod used to locate individuals who have been buried in snow.

Skier 5 also heard the guide's instruction to search on the eastern side of the narrow, wooded strip and headed toward the same location. Skier 5 took off his skis to facilitate movement over the snow masses and then continued on foot towards the eastern avalanche cone. After skier 5 had moved back to the eastern avalanche cone, past his previous track a few metres further down, his transceiver detected two signals indicating distance and direction. He also noticed that the guide and skier 6 had picked up a signal. They, together with the pilot, were making their way through the wooded area toward one of the positions. He then continued toward the other indicated position shown by his transceiver. The time was then approximately 16:14. Shortly thereafter, he saw part of a ski pole sticking up out of the snow.

The position towards which skier 2 and skier 6 were moving was the location where skier 3 was found.

Skier 5 reached skier 4's location at 16:17, i.e., 30 minutes after the avalanche had occurred. He began digging and was assisted by the pilot.

Skier 4 was buried shallowly, about half a meter under the snow, but one of his hands was stuck in the pole strap, which had ended up deeper in the snow. Partly because of the stuck hand, it took about ten minutes to dig skier 4 out. After his airway was cleared, skier 5 initiated cardiopulmonary resuscitation (CPR)[7]. Skier 4's lips were blue and he showed no signs of life. Skier 5 and the pilot took turns performing chest compressions and rescue breaths.

Skier 2 and skier 6 followed the directional indications on their transceivers and reached skier 3's position at roughly the same time. Skier 6 probed with the avalanche probe and got a strike. They immediately began digging at that spot. The guide joined a short while later and assisted with the excavation.

Skier 3 was found buried at a depth of approximately 1.5 metres and it took about ten minutes to dig him out. CPR was initiated for skier 3 at roughly the same time as for skier 4, i.e., at 16:27.

Neither skier 3 nor skier 4 had an activated (inflated) airbag.

The guide, the skiers and the pilot took turns and continued performing CPR until sometime between 16:34 and 16:59, when they were relieved by mountain rescuers. The exact time when the mountain rescuers reached skier 3 and skier 4 has not been possible to establish. Skier 5, who was medically trained, later chose to resume performing chest compressions on skier 4, as he judged that they were not being carried out correctly.

Figure 12 shows the positions of the skiers, as well as the search paths and final positions of the skiers, the guide and the pilot after the avalanche occurred.

[7] CPR (cardiopulmonary resuscitation) – life-saving chest compressions and rescue breaths administered in suspected cardiac arrest, until medical care or a defibrillator takes over.

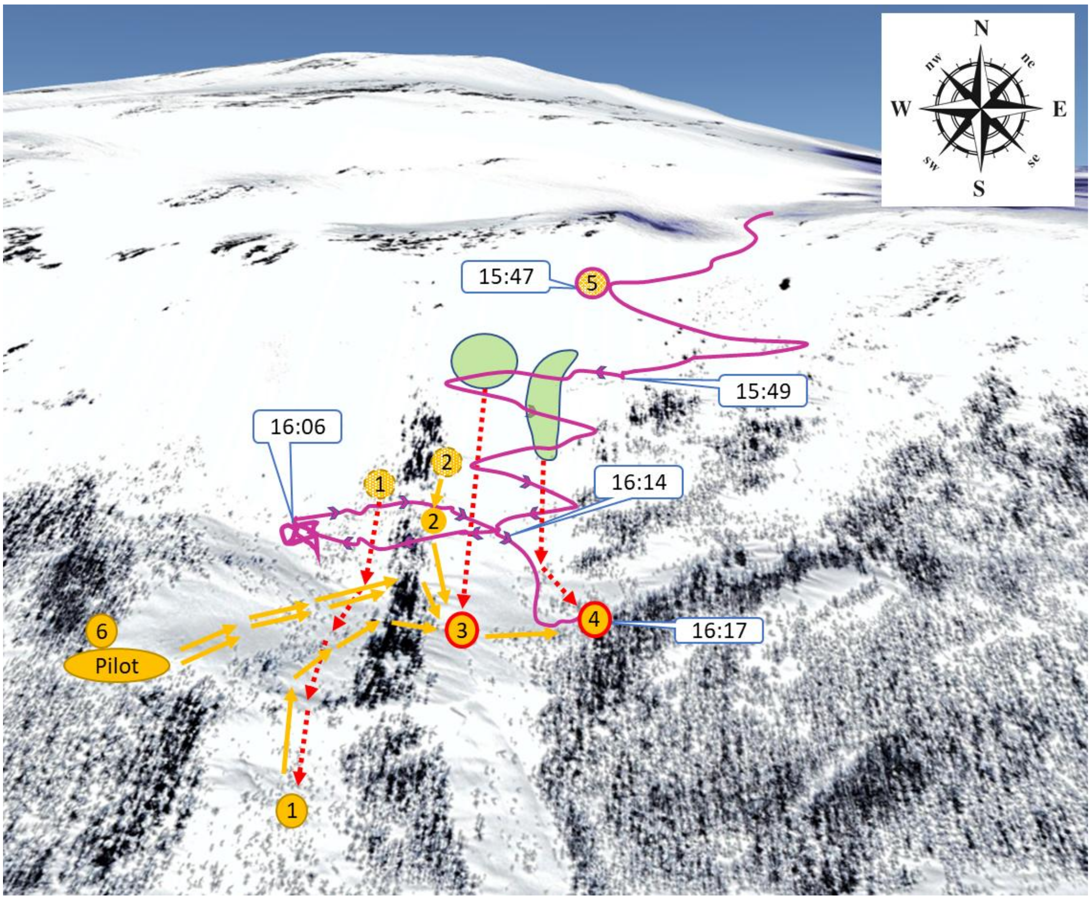

Figure 12. Satellite image showing the positions of those involved. The track for skier 5 is based on GNSS data and is shown in purple. The start and end positions (orange circles) during the avalanche event for the guide and skier 3 (green circle) are connected by red dotted arrows indicating a probable path in the avalanche. Orange arrows indicate the approximate search paths. Source: Google Earth, image date 2020-04-28. Markings added by SHK.

1.2 The rescue operation

When the avalanche had occurred and it became clear that several people were missing, the helicopter pilot alerted the operations manager at Niehku, who in turn notified SOS Alarm. Several of society's emergency resources were activated to manage the incident.

In this report, the term "rescue operation" refers to the collective response efforts undertaken by the municipal fire and rescue service, the police and the health and medical services to address the immediate consequences of the incident. Both the Police Authority and the Kiruna municipal fire and rescue service initiated the rescue operations in accordance with the Swedish Civil Protection Act. As a result, both municipal and state rescue services were initially engaged.

This section first provides a general description of how society's emergency resources are organised in the relevant area. This is followed by an account of the rescue operation following the accident.

1.2.1 General information about rescue services in mountain areas

Mountain rescue service

In the Swedish mountain areas, responsibility for the mountain rescue service lies with the Swedish Police Authority. This work comprises two main tasks:

1. To search for and rescue individuals who have gone missing under circumstances where there is reason to fear for their lives or where there is a serious risk to their health.

2. To assist individuals who have been involved in an accident or have fallen ill and are in urgent need of care or other assistance.

Rescue operations under the Civil Protection Act are led by an incident commander, who is also the police's on-duty officer. In this particular operation, the incident commander was based at the regional command centre in Umeå.

The mountain rescue service consists of volunteer mountain rescuers who have entered an agreement with the Police Authority. According to this agreement, they are required to respond to alerts and carry out rescue operations under the Civil Protection Act. In Norrbotten county, there are approximately 95 volunteer mountain rescuers. The mountain rescuers are trained and partially equipped by the police. Anyone wishing to become a mountain rescuer must possess extensive knowledge and familiarity with the mountain environment. Training begins with accompanying rescue operations for about a year, followed by a one-week basic training course. After that, annual further training of 24 hours is required. All mountain rescuers are trained in, among other things, radio communication, organised avalanche searches, advanced first aid and CPR. All mountain rescue groups are equipped with defibrillators, which, according to the police, must be brought to mountain rescue operations involving avalanches.

At the incident site, operations are led by an incident site officer from the mountain rescue service, who is a basic-trained mountain rescuer with additional training for this specific role.[8] According to the police, the incident site officer is expected, among other things, to manage the following tasks during a rescue operation under the Civil Protection Act:

- Assess the work environment risks for their own personnel.
- Communicate and cooperate with other actors at the incident site.
- Relay situational updates to the incident commander.

In Norrbotten county, the police also collaborate with ski patrollers working at Lapland Resorts ski facilities in Björkliden and Riksgränsen. The ski patrollers are trained through the Swedish Ski Areas Industry Association (SLAO) and work during the winter season to ensure safety at the ski resorts, prevent accidents and provide first aid in the event of accidents. The ski patrollers are also trained in avalanche rescue. Before each season, the ski patrollers are equipped with radios to use the Rakel communication system[9] and trained in how to use the radios. During mountain rescue operations, they receive alerts and can proceed to the accident site to provide an immediate initial response. The ski patrollers are

[8] The training includes, among other things, modules focusing on crisis management, the search for missing persons, incident command during avalanches, media management, police operational tactics, command principles and the command process.

[9] Rakel is the Swedish national communication system for public safety agencies (e.g., police, ambulance, fire service).

called in under the official duty[10] in accordance with the Civil Protection Act and are referred to as the “initial avalanche group”.

SOS Alarm has a mountain rescue coordinator based at the emergency call centre in Östersund. Accidents occurring in mountain areas can be difficult to manage. Therefore, the mountain rescue coordinator monitors emergency calls that are located within the Swedish mountain areas. This person can then ensure that the correct resources have been alerted, assist in establishing a radio communication plan for the operation and provide other relevant support for the response.

Municipal fire and rescue service

The Kiruna fire and rescue service is part of the Rescue Cooperation North (Räddningssamverkan Nord) and its alerting and command functions are connected to the rescue coordination centre in Luleå. In most cases, the duty officer at the rescue coordination centre acts as the incident commander for ongoing rescue operations in accordance with the Civil Protection Act and the highest-ranking officer at the scene of the accident is appointed as incident site officer. Kiruna Municipality and the Swedish Police Authority have an agreement that regulates cooperation in mountain areas.

Emergency medical services

Region Norrbotten provides pre-hospital medical care in Norrbotten and is therefore responsible for ambulance services, which include both road ambulances and air ambulance helicopters. SOS Alarm is responsible for receiving emergency calls, prioritising them, dispatching ambulances and directing them to the scene of the incident. Region Norrbotten has drawn up emergency response plans that must be followed when an emergency call is received.[11]

At the SOS Alarm emergency call centre in Luleå, during daytime hours, Region Norrbotten has, an experienced nurse who serves as the internal medical command and is responsible for ensuring that ambulance resources are available in Norrbotten. The internal medical command also monitors incoming SOS calls and can support the SOS operator by adding or removing ambulances from a dispatch.

Inter-agency coordination

Authorities have an obligation to assist each other during rescue operations under the Civil Protection Act. Parallel rescue operations may also occur, where different incident commanders are responsible for their respective operations.

In order for cooperation between the actors to take place, a communications plan is needed, specifying how they are to communicate with each other. Cooperation primarily takes place over Rakel, where the actors communicate using different so-called talk groups. Some talk groups are intended for cooperation between different actors participating in an operation, for example communication between the police and the fire and rescue service. Other talk groups are actor-specific, meaning that only information relevant to the specific actor should

[10] Official duty (Sw: *tjänsteplikt*) means a statutory obligation for certain individuals to participate in rescue operations when decided by the incident commander.

[11] A response plan specifies which resources are to be alerted for a particular type of incident

be shared there. This may concern tactical choices or details that do not affect anyone else, but only the organisation itself.

Talk groups can also be group-combined, meaning they are linked together so that actors on each talk group can communicate with each other. It is pre-planned which types of talk groups are to be used for different types of operations and how this should function bilaterally, nationally and actor-specifically.

Cooperation over Rakel requires coverage in the Rakel network. If coverage is lacking, the actors need alternative means of communication, for example satellite phone. If there is no coverage in the Rakel network, the radio terminals can be set to a mode where communication takes place from radio terminal to radio terminal, known as DMO mode, in which the radio terminals' function much like walkie-talkies. There are limitations in DMO mode, such as only being able to communicate with radio terminals already on the same talk group and within a certain geographical area.

The Swedish Civil Defence and Resilience Agency is working to replace the first generation of Rakel with a digital network for mission-critical communication services – SWEN (the Swedish Emergency Network). The new generation of Rakel, hereafter referred to as Rakel G2, will be able to utilise, among other things, existing communication infrastructure and the capabilities and resources of commercial actors can be used through procurement.

In Rakel G2, it will be possible to communicate in more ways than just by voice and text, which are the only options in today's Rakel communication. Rakel G2 will offer coverage across 94 percent of Sweden's area and coverage will be built in both sparsely populated and extremely remote areas. However, this will not be achieved through physical infrastructure alone, but also through satellite-based communication. Mission-critical actors will be able to communicate via Rakel G2 across the entire threat spectrum, i.e., both in peacetime and ultimately in war.

For the coordination of rescue work to be effective, radio discipline is required from those communicating over Rakel. This means, among other things, that calls should be made to functions and not individuals, that one should think before transmitting, that messages should be kept short and clear and that unnecessary talk should be avoided.

About the command of rescue operations

The number and scope of the tasks that need to be managed more or less simultaneously during an operation place great demands on the incident command. How burdened the incident commanders' span of control[12] becomes, depends both on how complicated the incident is and on the knowledge and experience of the commanders. During a rescue operation, several, sometimes life-critical, tasks often need to be performed within a short period of time. Therefore, it is important that routines and working methods are well-rehearsed and known, so that the correct actions can be taken without delay.

If a rescue operation grows, the command must be able to adapt to meet the increased needs and give the relevant command functions greater freedom of action, so that the operation

[12] The span of control concerns how many direct subordinates a person should lead, as well as which tasks that person is expected to manage in relation to the available time.

becomes effective.[13] The adaptation may, for example, involve appointing additional command functions. If an operation becomes larger but the command retains the same structure and working methods as for a simpler operation, there is a risk both that the individuals involved become overloaded and the operation becomes ineffective. A person participating in a rescue operation should have tasks of a similar character, such as a comparable level of difficulty in their duties, the number of subordinates and the content of the management work, regardless of whether the operation is large or small.

Overview of the rescue actors and their key tasks

Below is an overview of the actors who participated in the rescue operation, how their mandates are regulated and the key tasks they worked on (see Table 1). The next section describes the implementation of the rescue operation following the avalanche incident.

Table 1 Overview of the actors who participated in the rescue operation.

Organisation	Regulated responsibility	Key tasks during the rescue operation
Rescue actors		
The Swedish Police Authority	Chapter 4, Section 1 of the Civil Protection Act, regarding mountain rescue. ➢ Agreement with voluntary mountain rescuers. ➢ Agreement with Kiruna Municipality concerning the geographical boundaries for mountain rescue. Chapter 6, Section 1 of the Civil Protection Act, regarding official duty ➢ Ski patrollers are assigned under official duty.	➢ Initiated a rescue operation, mountain rescue. ➢ Incident commander at the regional command centre in Umeå. ➢ Alerted the mountain rescuers to the accident site, where they were led by an incident site officer from the mountain rescue service. ➢ Cooperated with ski patrollers (the initial avalanche group). ➢ Police helicopter at the scene.
Kiruna Municipality (Municipal fire and rescue service)	Chapter 3 of the Civil Protection Act regarding the municipality's obligations. ➢ Agreement with the police concerning the geographical boundaries for mountain rescue.	➢ Initiated a rescue operation under the Civil Protection Act. ➢ Incident commander at the rescue coordination centre in Luleå. ➢ Assisted the police in their mountain rescue operation.
Swedish Maritime Administration	Chapter 4, Section 2 of the Civil Protection Act, regarding aeronautical (air) rescue.	➢ Listened to the emergency call.

[13] An operation may grow for several different reasons. For example, this may be due to the involvement of many actors, a greater need for assistance than expected, or challenging terrain in which to operate.

Norway	Chapter 9, Section 1 of the Civil Protection Act, cooperation.[14]	➢ Responded with a SAR helicopter[15] and ambulance. ➢ Provided medical care to the skiers both at the scene and at the hospital in Norway.
Health and medical care		
Region Norrbotten	The Health and Medical Services Act.	➢ Responded with an air ambulance and a road ambulance.
Other actors		
SOS Alarm	The Emergency Dispatch Agreement, between the state and SOS Alarm. Regulates how the national emergency dispatch service is to be conducted.	➢ Received the 112 emergency call and connected the Swedish Maritime Administration, Region Norrbotten, the municipal fire and rescue service and the police to the call as listeners. ➢ Alerted rescue resources. ➢ Provided information about the incident to the rescue resources en route to the accident.

1.2.2 The execution of the rescue operation

Emergency call to SOS Alarm

When the avalanche occurred, the helicopter pilot alerted the operations manager at Niehku to inform them about the accident. The operations manager, in turn, alerted SOS Alarm at 15:52. In the emergency call, it was reported that an avalanche had occurred in Kårsavagge in connection with heliskiing. That there were seven people at the site and at least two of them were missing. It was further reported that a helicopter was involved in the accident. Since the operations manager was in Riksgränsen, the first position identified by SOS Alarm using the caller's mobile phone showed Riksgränsen and not the actual accident site.

It took approximately fifteen minutes for SOS Alarm to determine the actual location of the accident. SOS Alarm has stated that this was due to the positioning methodology not being followed. While work was ongoing to establish the location of the accident, resources were dispatched towards Kårsavagge and SOS Alarm attempted to call the pilot who was at the scene. The first attempt by SOS Alarm to call the pilot was at 16:03, but the call did not go through. The position could only be confirmed when the helicopter pilot called SOS Alarm from the accident site at 16:07. The pilot had tried to call SOS Alarm after calling the operations manager, but that call did not go through.

SOS Alarm connected the municipal fire and rescue service, the police, the Joint Rescue Coordination Centre (JRCC), Region Norrbotten and the mountain rescue coordinator to the

[14] As per the NORDRED agreement, which governs cooperation between the Nordic countries in the event of accidents

[15] SAR helicopter – Search and rescue helicopter

call as listeners. Both the police and the municipal fire and rescue service, initiated rescue operations.

Dispatch of rescue resources

SOS Alarm, the Swedish Police Authority and the municipal fire and rescue service dispatched several rescue resources. During the dispatch process, SOS Alarm decided not to alert the air ambulance based in Gällivare, as several helicopters had already been dispatched. However, by chance, the unit manager for the air ambulance was informed about the accident and noticed that the helicopter had not been alerted. The unit manager therefore called the staff at the helicopter base, who in turn contacted SOS Alarm and requested to receive the alert, after which they were able to proceed to the accident, approximately thirty-five minutes after SOS Alarm received the emergency call.

The municipal fire and rescue service alerted the Kiruna station and two voluntary fire units. The fire units were later informed that they did not need to proceed to the accident site and therefore stood down. The incident commander at the municipal fire and rescue service also requested assistance from Norway, which sent a SAR helicopter with medical personnel. According to the crew on board the helicopter, they were given the wrong position for the accident site and did not have maps of Sweden. They used their private mobile phones to try to locate the accident site. Thanks to spotting another helicopter, which they could follow, their response time was not delayed.

The police dispatched a helicopter and mountain rescuers to the accident site. A SAR helicopter from Umeå was also alerted, but while en route it was informed that it was not needed and returned to Umeå. Mountain rescuers who had recently completed a training course in Abisko were nearby and were able to reach the accident by snowmobile, bringing rescue dogs with them. The mountain rescuers did not have a defibrillator with them.

According to the incident site officer from the mountain rescue service, mountain rescuers travelling by snowmobile do not bring a defibrillator all the way to the accident site for all types of alerts. However, the police state that all mountain rescue groups have access to defibrillators and that these should be brought to all operations in connection with avalanche accidents. Two ski patrollers, the so-called initial avalanche group, were transported by private helicopter from Riksgränsen to the accident site. They were supposed to bring a defibrillator, but forgot to do so.

Care of the casualties

When the mountain rescuers arrived at Kårsavagge, they conducted a risk assessment of the terrain in order to work under safe conditions before beginning to attend to the skiers. The first mountain rescuers reached skiers 3 and 4 sometime between 16:34 and 16:59, i.e., between 47 minutes and one hour and 12 minutes after the avalanche was triggered.

At around 17:00, the private helicopter arrived with the initial avalanche group from Riksgränsen. The helicopter had been instructed by the incident site officer from the mountain rescue service to drop the avalanche group at the accident site and then fly to Abisko to collect defibrillators. However, a misunderstanding occurred and the helicopter flew from the accident site to Björkliden. Since there were no defibrillators there, the helicopter had to continue to Abisko. The helicopter collected two defibrillators and landed again at the accident site at 17:30. The defibrillators were then attached to skiers 3 and 4.

Shortly thereafter, both the air ambulance and the Norwegian SAR helicopter arrived at the accident site.

The doctor in the Norwegian SAR helicopter was winched down close to the location where the skiers had been uncovered. The Norwegian doctor checked the condition of both skiers before beginning medical treatment of skier 3. The doctor determined that the skier showed no signs of life and the defibrillator indicated asystole[16]. The skier's body temperature was measured and the low temperature indicated that the person could be hypothermic[17]. The doctor then followed the guidelines for further treatment, which meant that skier 3 was winched up to the Norwegian SAR helicopter at 18:43 and transported to the University Hospital in Tromsø for further warming and continued care. At the hospital, skier 3 was later declared deceased.

The air ambulance landed in the valley below the avalanche cone. This was done for the following reasons:

- The pilot believed that an active search was underway in the area with rescue dogs from the mountain rescue service. The pilot therefore followed the routine of not flying over the avalanche cone during an ongoing search, so as not to disturb any tracks with the helicopter's downdraft. According to information provided during the investigation, the dogs were not used in an active search.

- The crew had understood from the information received at the time of the alert that the skiers were near the helicopter and had not received any updated information about the skiers' positions while en route to the site.

From the landing site of the ambulance helicopter, the medical personnel had to climb up the snow masses to reach the skiers, which took just over 30 minutes. The nurse, who was experienced in moving in mountainous terrain, reached skier 4 at 18:10. When the nurse arrived, she found that skier 4 had a blocked airway and therefore established a clear airway. The doctor arrived about 15 minutes later. The defibrillator indicated asystole and therefore instructed those performing CPR to continue with chest compressions and ventilations. After a short time, resuscitation efforts were discontinued in accordance with European criteria for casualties in avalanche accidents.

The air ambulance was low on fuel and dusk was approaching. It therefore returned to Abisko after the medical personnel had disembarked in the vicinity of the accident site. The Swedish medical personnel and skier 4 were transported to Abisko by snowmobiles from the mountain rescue service and from there on to Kiruna Hospital.

The other individuals involved in the accident were transported by helicopter to Riksgränsen, where they were examined by a doctor and received care for their injuries.

[16] Asystole – Cardiac arrest in which all electrical activity of the heart has ceased. Cannot be treated with defibrillation.

[17] Hypothermic – This means that even if the heart has no electrical activity, hypothermia can potentially protect the brain's cells and resuscitation may be possible once the patient has been rewarmed.

Coordination and command of the operation

The police led the mountain rescue operation under the Civil Protection Act through an incident commander, who was based in Umeå and an incident site officer from the mountain rescue service who operated from the police station in Abisko. The Kiruna fire and rescue service had an incident commander at the rescue coordination centre in Luleå and an incident site officer at the site in Abisko. The incident site officer from the mountain rescue service communicated to incoming units that the forward control point[18] was at the police station in Abisko.

SOS Alarm established a radio communications plan according to routine, but misunderstandings arose regarding its design. The JRCC was of the opinion that they could not communicate on the talk group already assigned to the operation and therefore requested that SOS Alarm assign a different talk group. Talk groups for both bilateral and national cooperation were activated and grouped together. The fact that it was not possible to connect the different talk groups made it more difficult to establish a functional communications plan.

In the area where the accident occurred, radio coverage was poor, which complicated communication. Above the avalanche cone, there was coverage in the Rakel network, but in the valley there was no coverage. It was therefore necessary to operate in DMO mode there. The ability to reach each other in DMO mode was lost when someone climbed up the avalanche cone and moved out of range of the radio terminal in the valley.

When the air ambulance landed below the avalanche cone, they had no contact on the predetermined talk group and switched to DMO mode. The mountain rescuers, who were further up the mountain, had coverage on the Rakel network and were thus not on the DMO talk group. As a result, the ambulance personnel could not communicate with the mountain rescuers after the helicopter had landed and the ambulance personnel were on the ground.

No ground-based rescue resource had radio contact with the Norwegian SAR helicopter. The Norwegian SAR helicopter had contact only with the other helicopters.

It also emerged during interviews and from recordings of radio traffic that radio discipline was lacking on the talk group intended for cooperation[19] between the rescue resources working at or en route to the accident site. These shortcomings in radio discipline were evident, for example, in the fact that many calls were made to individuals rather than functions and that much actor-specific information was shared on the cooperation talk group instead of on internal talk groups. This made it difficult for actors to share or request important information.

SHK also notes that the mountain rescuers working at the site in Kårsavagge had no markings[20] indicating that they belonged to the mountain rescue service. According to the police, this was because they, in order to save time, went directly to the accident site from an exercise where they lacked markings.

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[18] Geographical location where rescue units assemble while awaiting assignment of tasks.

[19] This talk group was, in practice, several talk groups that were combined as a group.

[20] In this context, distinguishing insignia, clothing, or badges that could identify the individuals as mountain rescuers are meant.

Conclusion of the rescue operation

The municipal fire and rescue service concluded its rescue operation under the Civil Protection Act at 17:18, but rescue resources remained on site and continued to participate in the Police's rescue operation under the Civil Protection Act. The mountain rescuers returned to Abisko shortly after 20:00 and the Police formally concluded their rescue operation under the Civil Protection Act at 03:10.

1.3 Injuries

1.3.1 Personal injuries

Skiers 3 and 4 were buried in the avalanche cone and were found after approximately 30 minutes. CPR was initiated after another 10 minutes, i.e. after a total of about 40 minutes.

Skier 4 was pronounced dead at the scene by a doctor, whereas skier 3 was pronounced dead at the university hospital in Tromsø.

The investigation strongly suggests that the cause of death for both individuals was asphyxiation, as a result of being completely buried under snow masses in connection with the avalanche. According to established medical knowledge, the chances of survival after such prolonged complete burial in snow are extremely small.

The pilot and the guide sustained minor injuries, including a knee injury and lacerations to the head and face.

1.3.2 Material damage

The helicopter tipped over and was pushed backward when it was struck by the avalanche, causing the tail boom to hit the ground. This resulted in damage to the tail boom attachment.

1.4 The accident site

Kårsavagge

The accident occurred in Kårsavagge, which is a U-shaped valley located in the Abisko Mountains, approximately 10 kilometres southwest of the village of Abisko in Kiruna Municipality. The valley stretches in an east-west direction and is situated between high mountain massifs, known as the Abisko Alps. Kårsavagge begins at the Abiskojåkka River, which flows from the Abisko Alps and continues westward into the massif; see figure 13.

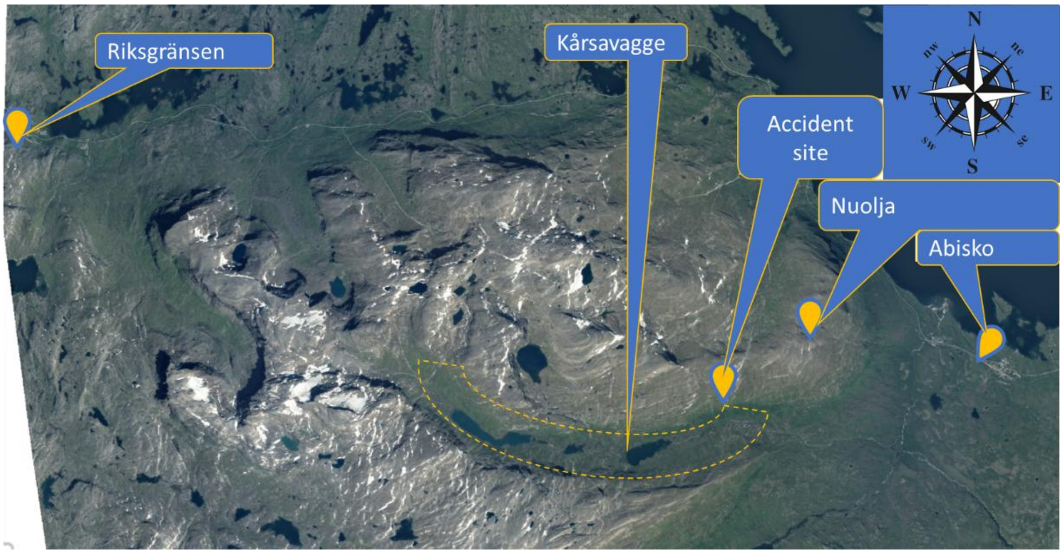


Figure 13. Aerial photograph of Kårsavagge and surrounding areas. Source: Lantmäteriet. Markings inserted by SHK.

The valley base lies at an elevation of 500–700 metres above sea level, while the surrounding mountain peaks reach heights of up to 1,500 metres above sea level. The surrounding mountains create a distinct contrast between the wide valley base and the steeper slopes that encircle it. The most prominent peaks nearby are Slåttatjåkka: 1,196 m a.s.l., Låktatjåkka: 1,231 m a.s.l. and Nuolja: 1,164 m a.s.l. These peaks surround Kårsavagge and influence the snow conditions by creating areas where wind can transport and accumulate snow. The valley is characterised by a combination of gentler terrain and steep slopes. Near the valley base, the inclination is generally less than 30 degrees and gentle areas also occur higher up along the mountain ridge. The tree line lies at 600–700 metres above sea level, with mountain birch forest dominating the lower parts of the valley. Above the tree line, the landscape transitions to bare mountain terrain with exposed areas and rock. Kårsavagge is situated in a windswept area where snow is often redistributed by strong westerly winds that accumulates on leeward slopes, especially where the terrain becomes steeper.

The area generally experiences low levels of precipitation and often clear skies, even when nearby areas may be experiencing ongoing snowfall. For this reason, the area is often chosen for helicopter skiing when weather conditions restrict flying in other areas around Riksgränsen.

1.5 Interviews

SHK has conducted interviews on several occasions, both with the parties involved and with guides, educational bodies and organisations that establish and monitor standards for safety and operations, as well as with avalanche experts. Below is a summary of the interviews with the guide, the surviving skiers and other mountain guides active in Riksgränsen who were interviewed.

1.5.1 The guide

The guide has stated that communication with the skiers was conducted in English. He felt that everyone in the group understood his instructions. He assessed the group as competent skiers with considerable experience, who followed the instructions well and kept to his tracks. He therefore judged that there was no reason for remarks or frequent repetitions of the instructions. He perceived the group as very cohesive.

He has stated that he chose skiing lines in order to avoid areas with slopes exceeding 30 degrees. The skiing mainly took place on gentler slopes, although the group occasionally skied adjacent to avalanche terrain. Along the runs, the guide would stop to keep an eye on the skiers. Before the final run, the guide instructed the skiers to follow his tracks.

1.5.2 The skiers

The surviving skiers have stated in interviews that they did not fully grasp all the information provided during the safety briefing. Some described the safety briefing as rather brief. Certain instructions, particularly regarding the handling and function of avalanche equipment, were either not mentioned at all or were not entirely clear to them.

Only two of the skiers felt confident with English. The others reported that they did not catch or understand everything that was said and that communication with the guide was primarily conducted through skier 3, who had good English skills and was also the person who had booked the trip.

The skiers perceived the runs as short and gentle, with predominantly poor snow conditions (ice with only occasional patches of powder snow). The skiers also reported that the guide often skied ahead without waiting for the group. They regarded the runs as easy and harmless, an impression reinforced by the fact that the guide was not wearing a helmet.

According to the guests, prior to the final run they were informed that it would take place at a different location, but they did not receive any updated specific instruction to follow the guide's tracks. During the final run, they say that they did not see the guide either at the steeper section nor below.

Skier 2 has stated that, as she was slower than the others, she tried to maintain as high a speed as possible after the steeper section, focusing on catching up with the guide. As a result, she did not pay attention to the whereabouts of the other skiers.

Skier 5 reported that he lacked visual contact with the guide and the other skiers during the critical phase (before and on the steep slope). He stated that the terrain before the steep section was such that there was only one possible passage to follow in the fall line. Immediately after the steeper section, he does not recall whether he followed tracks from the other skiers. He did not see any other skier ahead of him, but noted that it was a natural route through the area and he felt there were not many alternative choices.

Skier 2 and skier 5 have stated that they do not share SHK's assessment of the reconstructed lines of descent.

1.5.3 Other interviewees

From interviews with a number of guides (including the guide involved in the incident), it has emerged that risks identified by guides are not always communicated to the guests. They stated that the reason for this is partly that the risks are changeable and are assessed continuously and that guests may react differently to risk information and sometimes make unexpected decisions, which in itself is considered an additional risk factor.

Interviews with other heli-skiing operators have revealed that terrain databases can be used as a support tool in planning and risk analysis. One of the operators interviewed in the Riksgränsen area stated that they use such resources to map out possible runs, landing sites, pick-up points and risk-reducing measures in advance. The operator also noted that these locations are regularly scouted in the field.

HeliCat Canada has described that the use of terrain databases and the reconnaissance of predetermined slopes is common practice in Canadian heli-skiing. However, the conditions differ from those in Sweden, not least because Canadian operators often operate within defined areas, to which they have exclusive rights.

1.6 Meteorological information

The weather in the area Riksgränsen/Abisko exhibits significant local and temporal variations. Weather conditions can change dramatically within the space of minutes to hours, but also over days and months. One example of this is that the snow depth can differ considerably between Riksgränsen and Abisko.

The area around Kårsavagge and Abisko is known for frequently having clear weather, even at times when visibility is poor in the surrounding region. Due to the mountain massif west of Abisko (where Kårsavagge is located), there is a so-called *föhn gap*. This means that, because of the commonly prevailing westerly winds – particularly on the leeward side in high terrain – there is not as much precipitation as in the surrounding areas.

During the last five days prior to the accident, there had been heavy snowfall and strong winds in both the Abisko and Riksgränsen mountains (although there was less precipitation in the local areas around Abisko and in the eastern part of the Kårsavagge valley). The prevailing wind direction during these days was from the west, with recorded gusts exceeding 20 m/s. The most recent independent weather observation from the site came from the crew of a military helicopter flying in the area shortly before the accident on 20 March. They reported numerous snow showers and severely reduced visibility.

Weather data from the days preceding the accident were collected from a measuring station at the summit of Mount Nuolja, which is situated directly adjacent to Kårsavagge. The data indicate westerly winds of around 30 m/s, resulting in drifting snow; see figure 14. The weather conditions on 20 March are also shown; there were westerly winds of approximately 17 m/s.

Figure 14. Weather data from the measuring station located on Mount Nuolja. Source: Swedish Environmental Protection Agency (Naturvårdsverket).

Overall, the weather developments during the period 14–20 March resulted in significant amounts of wind-transported snow accumulating on leeward slopes with north, east and south exposure, on top of previous snow layers. The newly deposited snow accumulated and formed a thick and cohesive slab above the underlying weak layers. The uneven snow distribution meant that the slab became very thick in certain areas, which contributed to the large extent of the avalanche.

On 20 March 2025, the sun rose at 05:43 and set at 18:02 in Abisko. This meant that it was daylight when the avalanche was triggered, but that dusk was falling as the helicopters involved in the rescue operation arrived at the accident site.

1.6.1 Avalanches

An avalanche is a movement of snow that detaches from a slope and moves downhill under the influence of gravity. Avalanches occur when the load on the snowpack exceeds its strength. The conditions for avalanche formation are affected by several factors, including the snowpack and its stratification, weather conditions and external influences such as human activity. Slab avalanches most commonly occur on slopes with an inclination between approximately 30 and 45 degrees. Avalanche terrain is terrain where an avalanche can be triggered or where an avalanche can reach.

The snowpack often consists of several layers with different properties. If a weak layer of snow is covered by a more cohesive layer – a so-called slab – this can create the conditions for a slab avalanche, if the terrain is sufficiently steep. Weather conditions such as heavy snowfall, wind-transported snow and rapid temperature changes are signs of increased avalanche risk. Under these conditions, avalanches are often triggered spontaneously. Human activity, such as skiing, can also provide sufficient load to trigger an avalanche.

Avalanches are usually divided into two main categories: *loose snow avalanches* and *slab avalanches*. Avalanches can be triggered naturally or by external influences and can become large and extremely powerful. Accidents involving skiers most often occur in connection with slab avalanches. Slab avalanches can, in turn, be divided into different subtypes depending on how the slab and the weak layer have formed. Wind slab is the most common avalanche problem in the Swedish mountain regions and is a recurring main problem in the Abisko/Riksgränsen mountains.

A slab avalanche occurs when a cohesive layer of snow breaks away above a weak layer and begins to move down the slope. As it travels, the slab usually breaks up into smaller blocks and snow masses. After a slab avalanche, a distinct fracture line is often visible in the area where the slab detached. When the avalanche comes to a halt, the snow is deposited in the run-out zone, often forming an avalanche cone or another cohesive accumulation of avalanche snow, see figure 15. The deposited snow can often become densely packed and compact.

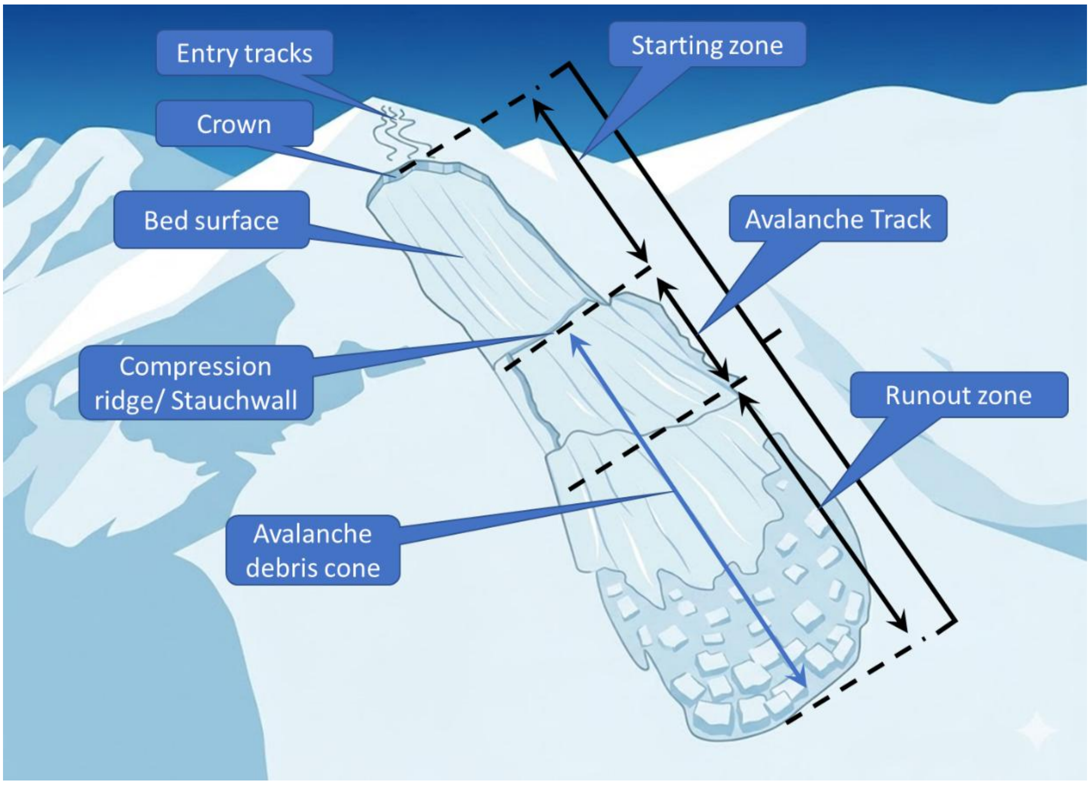


Figure 15. Illustration of a slab avalanche and the terminology for its various parts.

A specific subtype of slab avalanches is the *persistent slab avalanche*. These can propagate rapidly and cover a large area. This type of avalanche occurs when a weak layer in the snowpack, such as faceted crystals[21] or surface hoar, persists for an extended period. Persistent slabs are known for being difficult to detect and treacherous; they can be remotely triggered from thinner parts of the snowpack,[22] and in some cases can even be remotely triggered from terrain with a slope of less than 30 degrees. This means that a skier located below a steeper snowfield can trigger an avalanche from a distance, for example from the side or from below. The likelihood of a skier affecting a weak layer increases where the overlying snowpack is thin, often in the order of less than approximately 0.5 metres. However, there is no sharp boundary, since the load transfer is influenced by factors such as the hardness of the snow, its layering and the properties of the weak layer.

[21] Snow crystals that have been transformed due to significant temperature differences within the snowpack (temperature gradients). This process causes rounded, well-bonded snow grains to change into angular crystals with flat surfaces and sharp edges. These have a very poor ability to bond to one another, creating a sugar-like, deeply buried weak layer that can persist throughout the winter.

[22] J. Schweizer and C. Camponovo, "The skier's information stress bulb," Annals of Glaciology, vol. 32, pp. 298–302, 2001; J. Schweizer and C. Camponovo, "The skier's zone of influence in triggering slab avalanches," Annals of Glaciology, vol. 32, pp. 314–320, 2001; and J. Schweizer and M. Lütschg, "Characteristics of human-triggered avalanches," Cold Regions Science and Technology, vol. 33, no. 2-3, pp. 147–162, 2001.

The size of the avalanche depends on the amount of snow, the slope angle and the strength of the snow. The size of a slab avalanche can vary. It may be small, for example a few metres wide and long, with a crown fracture of a few decimetres. It can also be much larger, several hundred metres wide and long with a crown fracture several metres deep. The speed at which an avalanche travels varies with the steepness and length of the slope – the steeper and longer the slope, the faster the avalanche. On a steep and long slope, an avalanche can reach a speed of over 100 km/h.

1.6.2 Avalanche danger

Avalanche danger is the potential for an avalanche, or several avalanches, to cause harm to something of value (e.g. people, nature, or property).[23] Avalanche danger is graded according to a European five-level scale, which is used in most countries with mountainous terrain (e.g. Sweden, Norway and Alpine countries); see figure 16. The five levels of avalanche danger reflect the likelihood of avalanches occurring and the possible size of avalanches.

[23] Statham et Al, "A conceptual model of avalanche hazard," Nat Hazards, vol. 90, p. 663–691, 218.

Avalanche Danger Scale

LAVINPROGNOSER

Symbol	Danger Level	Recommendation	Snowpack Stability	Likelihood of Triggering
5	**5** Very High	Extraordinarily dangerous avalanche conditions. Avoid all avalanche terrain.	The snowpack is poorly bounded and largely unstable in general.	Numerous very large and often extremely large natural avalanches can be expected, even in moderately steep terrain*.
4	**4** High	Very dangerous avalanche conditions. Travel in avalanche terrain not recommended.	The snowpack is poorly bonded on most steep slopes*.	Triggering is likely, even from low additional loads**, particularly on the indicated steep slopes*. In some cases, numerous large and often very large natural avalanches can be expected.
3	**3** Considerable	Dangerouos avalanche conditions. Careful snowpack evaluation, cautious route-finding, and conservative decision-making essential.	The snowpack is moderately to poorly bonded on many steep slopes*.	Triggering is likely, even from low additional loads**, on many steep slopes*. In certain situations som large, and in isolated cases very large natural avalanches are possible.
2	**2** Moderate	Heigtened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern.	The snowpack is only moderately well bonded on some steep slopes*, otherwise well bonded in general.	Triggering is possible, primarily from high additional loads**, particularly on the indicated steep slopes*, particularly on the indicated steep slopes*. Very large natural avalanches are unlikely.
1	**1** Low	Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.	The snowpack is well bonded and stable in general.	Triggering is gererally possible only from high additional loads** in isolated areas of very steep, extreme terrain*. Only small and medium natural avalanches are possible.
	Not Assesed	The conditions are unknown. Assess the snow cover and terrain carefully. Be very careful when choosing where and how you ride. Assume conditions may be dangerous until proven otherwise.	The stability of the snow cover is not assessed.	Avalanche probability is unknown and can range from very unlikely to almost certain. Avalanches can be anything from small to very large.

Figure 16: Avalanche danger scale. Source: Swedish Environmental Protection Agency (Naturvårdsverket).

According to the European Avalanche Warning Service (EAWS), approximately half of all fatal accidents occur when the avalanche danger level is at level 3. The avalanche danger scale does not increase linearly; instead, the danger doubles with each step up the scale.

1.6.3 Avalanche forecasts and the relevant forecast

Avalanche forecasts are produced by professional avalanche experts and compiled based on weather data, snow profiles, wind conditions and observations in the terrain. In Sweden, the Swedish Environmental Protection Agency (Naturvårdsverket) is responsible for avalanche forecasts through the national avalanche forecasting programme. The forecasts are published on the website lavinprognoser.se, which also contains information in English. The data that constitutes the base of the forecasts include, among other things:

- Data from snowpack analysis: The analysis is carried out by digging snow profiles and examining the layers in the snowpack (e.g. weak layers, crust, grain structure).

- Weather data: Wind strength and direction, precipitation (snowfall), temperature and temperature changes. This can provide an indication of wind-transported snow, which may lead to large amounts of snow accumulating on leeward slopes and creating wind slabs.

- Data from terrain observations: Evidence of previous avalanches, cracking, sounds from the snowpack and other signs of instability.

The forecast area for Abisko/Riksgränsen is shown in figure 17. When an avalanche forecast is prepared, the area is further divided into two sub-areas, with the area assessed as having the highest level of avalanche danger setting the overall level for the forecast.

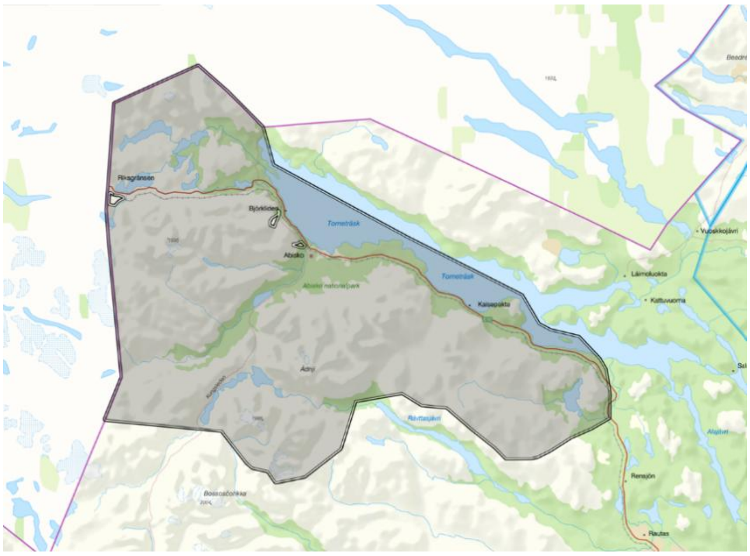


Figure 17. Forecast area Abisko/Riksgränsen. Source: Swedish Environmental Protection Agency (Naturvårdsverket).

The avalanche forecast on the website lavinprognoser.se is updated daily. An assessment is also made regarding the development of avalanche danger for the following day. The forecasts contain information about the weather, avalanche problems and their locations. It is possible to zoom in on specific areas and slope angles can also be viewed (this view needs to be activated separately).

Forecasters use a web-based tool called InfoEx[24], which contains detailed information, descriptions, images and historical records about avalanches and snow conditions. At the time of the incident, the system included information such as avalanche activity in the local area, as well as comments on current avalanche problems. The system was available to mountain guides operating in Riksgränsen.

However, according to interview responses, it was not used regularly, as it was not perceived as user-friendly. The system relies on users submitting observations and the amount of information therefore depends on the extent to which such reports are provided. Several interviewed guides and operators stated that, in practice, the system is perceived as limited or less suited for operational use in the field. In the relevant operation, InfoEx was not used as a decision support tool prior to or during the day in question.

To facilitate the sharing of observations regarding snow conditions, avalanches and avalanche problems, a joint digital information channel has been established since 2022 in the form of a WhatsApp group. Professional organisers, mountain guides and avalanche forecasters in the Riksgränsen mountains are included in this information channel.

Avalanche Forecast 14–20 March 2025

The avalanche danger forecast for the area changed from level 1 on 14 March to level 3 on 16 and 17 March. On 18 March, the forecast was raised to level 4, before returning to level 3 on 19 and 20 March. Below, in figure 18, the daily forecasted avalanche danger between 13 and 20 March is shown.

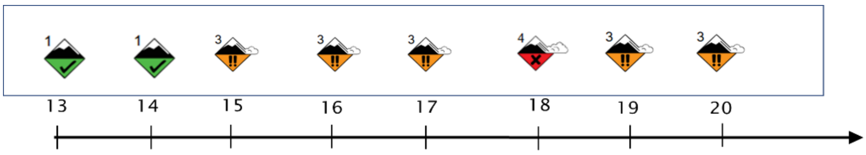
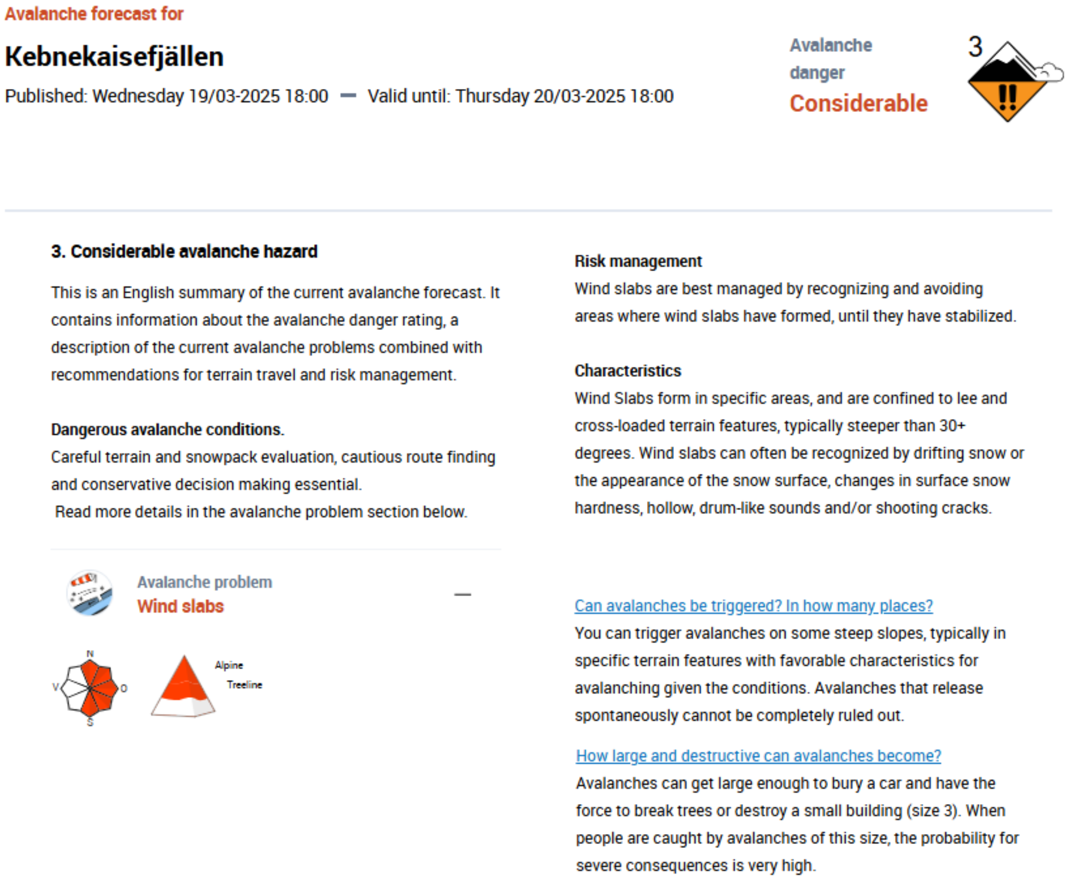


Figure 18 Level of forecasted avalanche danger for the forecast area Abisko/Riksgränsen for the specified dates in March 2025.

The detailed avalanche danger forecast for the Abisko/Riksgränsen mountains for 20 March 2025 is shown in figure 19. It stated that the avalanche problem consisted of wind slabs on open mountain terrain and steeper slopes within a continuous sector from north through east to south. If the risk of persistent slabs is identified in an avalanche forecast, guides usually pay particular attention to this and avoid such types of terrain or especially sensitive areas when planning skiing activities.

[24] InfoEx – A digital system for the professional exchange of avalanche data and snow observations between guides, ski patrols and authorities (e.g. the Swedish Environmental Protection Agency).



Avalanche forecast for

Kebnekaisefjällen

Published: Wednesday 19/03-2025 18:00 — Valid until: Thursday 20/03-2025 18:00

Avalanche danger
3
Considerable

3. Considerable avalanche hazard

This is an English summary of the current avalanche forecast. It contains information about the avalanche danger rating, a description of the current avalanche problems combined with recommendations for terrain travel and risk management.

Dangerous avalanche conditions.
Careful terrain and snowpack evaluation, cautious route finding and conservative decision making essential.
Read more details in the avalanche problem section below.

Avalanche problem
Wind slabs

N V O S

Alpine
Treeline

Risk management
Wind slabs are best managed by recognizing and avoiding areas where wind slabs have formed, until they have stabilized.

Characteristics
Wind Slabs form in specific areas, and are confined to lee and cross-loaded terrain features, typically steeper than 30+ degrees. Wind slabs can often be recognized by drifting snow or the appearance of the snow surface, changes in surface snow hardness, hollow, drum-like sounds and/or shooting cracks.

Can avalanches be triggered? In how many places?
You can trigger avalanches on some steep slopes, typically in specific terrain features with favorable characteristics for avalanching given the conditions. Avalanches that release spontaneously cannot be completely ruled out.

How large and destructive can avalanches become?
Avalanches can get large enough to bury a car and have the force to break trees or destroy a small building (size 3). When people are caught by avalanches of this size, the probability for severe consequences is very high.

Figure 19. Information from the web page lavinprognoser.se regarding the avalanche danger forecast for 20 March 2025. Source: Swedish Environmental Protection Agency (Naturvårdsverket).

1.6.4 The avalanche

The assessment of the avalanche in Kårsavagge was carried out by avalanche experts at the Swedish Environmental Protection Agency. Their assessment is that the avalanche was a skier-triggered slab avalanche of the persistent slab type. The avalanche was assessed to have a destructive size of 3.5 on the international scale (1–5). This means that it was large enough to cause significant damage to forest and smaller buildings and posed a serious danger to people in the terrain.

The statement from the Swedish Environmental Protection Agency also shows the following:

The crown fracture measured approximately 430 metres in length and the slope inclination in the fracture area varied between 32 and 45 degrees. The thickness of the crown fracture was measured at between 100 and 340 cm, with an estimated average of around 250 cm (measured vertically). The total width of the avalanche was estimated to be approximately 350 metres.

During examination of the snowpack, two weak layers (so-called failure planes) were identified, which are believed to have contributed to the instability. The first layer consisted of a faceted layer[25] adjacent to a crust that formed during mild weather around 7 February.

[25] Faceting is a process that transforms small snow crystals into larger and more angular shapes, which can eventually develop into cup-shaped forms. This process occurs when there are significant temperature differences within the snowpack.

The second layer consisted of a faceted layer adjacent to a crust that formed during mild weather around 22 February. These weak layers were located beneath a cohesive snow slab and are considered, together, to have created the conditions for a larger slab avalanche.

The avalanche is assessed to have been capable of remote triggering from an area with a thinner snow cover and a shallower slope (less than 30 degrees). Such remote triggering could have occurred from the side or from below in relation to the fracture line.

1.6.5 Statistics for avalanche accidents

Since 2001, the Swedish Environmental Protection Agency has maintained statistics on fatal avalanche accidents in Sweden. Below, the statistics are presented broken down by type of activity, as well as trends over time; see figure 20 and figure 21.

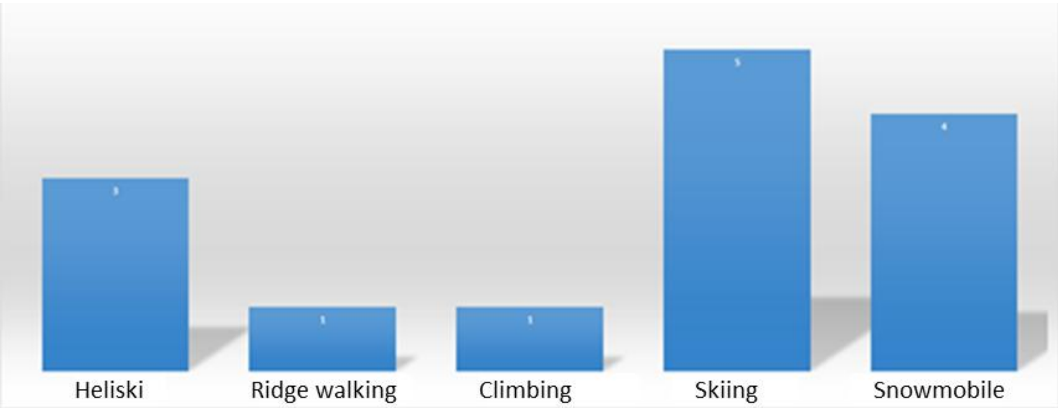


Figure 20. Statistics on fatal avalanche accidents after 2001, broken down by area of activity. Source: Swedish Environmental Protection Agency. from left to right: heliski, ridge hiking, climbing, skiing/snowboarding, snowmobiling Note that the number of accidents is stated and not the number of fatalities.

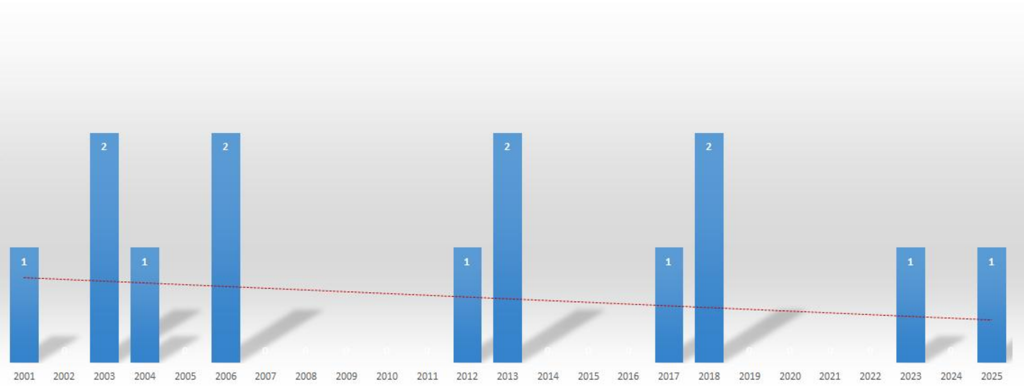


Figure 21. Trend over time for fatal avalanche accidents after 2001. Source: Swedish Environmental Protection Agency.

The Swedish Environmental Protection Agency also maintains statistics on fatal accidents involving Swedes abroad after 2001.

1.7 Survival aspects in avalanche accidents

Survival outcomes in avalanche accidents are influenced by several interacting factors, including avalanche type, the size and kinetic energy of the avalanche and the terrain in which the avalanche occurs. The nature of the terrain is of particular significance for the severity of injuries. The main cause of death in avalanche accidents is asphyxiation as a result of burial under snow masses. In general, approximately 75% of victims die from asphyxiation, around 24% from trauma and about 1% from hypothermia.[26, 27]

Studies based on long-term Swiss data indicate that the probability of survival in cases of critical burial (head and chest covered by snow) is highly time-dependent. A study published in 2024 analysed avalanche accidents between 1981 and 2020. The study did not include cases where the cause of death was assessed to be trauma. The study showed that the probability of survival was approximately 91% if the buried person was rescued within the first 10 minutes. In cases where rescue occurred after ten to thirty minutes, the probability of survival dropped to around 31%. The study showed that the probability of survival was approximately 21% for accidents in which the person had been buried for between 60 and 180 minutes. In these cases, the cause of death was primarily assessed to be asphyxia (lack of oxygen) and hypothermia.[28]

Overall, available statistics indicate that survival in avalanche accidents is highly dependent on both the time elapsed until extrication and whether the victim has sustained serious trauma during the movement of the avalanche.

1.8 Heli-skiing

Heli-skiing is a form of guided skiing activity where participants are transported by helicopter to mountain areas outside groomed ski areas and then ski or snowboard under the supervision of a guide. The often takes place in or adjacent to avalanche terrain.

In practice, the activity consists of two distinct elements:

- The helicopter transport to and from skiing locations.
- The guided skiing in terrain.

The guide is responsible for the planning and execution of the skiing, which includes:

- Selecting the area and runs based on weather, snow conditions and the group's abilities.
- Reconnoitring the terrain and planning the choice of route.
- Instructing participants regarding the order of descent, stopping points and communication.
- Leading the group during the descent and adapting decisions according to prevailing conditions.

[26] S. R. e. al., "Avalanche Survival Rates in Switzerland, 1981–2020," JAMA Network Open, vol. 7, nr 9, 2024.

[27] A. R. (SLF), "Long-term statistics on avalanche accidents," WSL Institute for Snow and Avalanche Research (SLF), 2025.

[28] M. E. e. al., "Avalanche survivability after long burial," Resuscitation, 2021.

The guide's responsibility, in addition to assessing and managing risks, is also to provide the guests with a good experience.

According to industry practice, the guide should have up-to-date knowledge of avalanche equipment and be proficient in companion rescue, but the guide is not responsible for training the guest in these matters. The guest is provided with a transceiver and the guide must ensure that it is transmitting, so that the guest can be located in the event they are caught in an avalanche. There is no requirement for the guests to have knowledge of or skills in companion rescue or in the use of avalanche equipment. Nor are the guests expected to be able to perform an avalanche search for the guide. The increased risk this may entail is something the guide is expected to be aware of and to accept.

Guiding is often conducted with a skiing order in which the guide goes first, or more rarely, last. When the guide goes first, the group is led by the guide's tracks, route choices and instructions. However, the nature of the terrain may mean that the guide is not visible to all participants throughout the descent. An important safety aspect during skiing is that skiers maintain spacing between each other to reduce the group's simultaneous exposure to avalanche terrain. In guided activities, risk management is dependent on participants following the mountain guide's instructions and route choices.

In heli-skiing, guides do not always wear a helmet while skiing. The reason is that during helicopter flights, the guide and pilot communicate via an internal communication system with a microphone and headphones. When the runs are short, as they were on the day in question, there are many frequent boardings and disembarkations from the helicopter. In such situations, the guide – as well as several other guides interviewed by SHK – found it cumbersome to wear a helmet, as it must be put on and taken off at each helicopter lift. Another reason pointed out by guides is that the helmet muffles sound impressions when they are skiing and assessing the snow.

During helicopter transport, guests are not always provided with headsets, but remain wearing their helmets, which means they have limited ability to communicate easily with the guide or the pilot. Niehku and Kallax Flyg do not provide guests with headsets.

1.8.1 Mountain guide training

Organisation and certification

The Swedish Mountain Guide Association (Svenska Bergsguideorganisationen, SBO) is responsible for the training and certification of mountain guides in Sweden, in accordance with the common training platform of the International Federation of Mountain Guide Associations (IFMGA). IFMGA certification covers all disciplines within mountain guiding, including guiding of off-piste skiers in avalanche terrain and constitutes a prerequisite for professional guiding in most alpine countries.

Scope and implementation of the training

The training is normally carried out over a five-year period and must be completed within six years. It comprises at least 94 days of structured group training, examinable course modules, as well as supervised and unsupervised practical service in a real guiding environment.

Avalanche risk management and decision-making

For the guiding of off-piste skiers in avalanche terrain, several training modules are included with a particular focus on avalanche risk management, professional decision-making and group leadership. Central components are the Avalanche and Ski Guiding Course and SVELAV PRO 2 – Avalanche Technician Course. Together, these are intended to provide candidates with the ability to independently and professionally assess avalanche danger, classify avalanche terrain, collect and prioritise relevant decision-making information and communicate risks to guests and other stakeholders.

Risk communication and human factors

Risks should be communicated in a comprehensible manner, with the aim of building trust with the guests. The information should also be adapted to the competence level of the group. The SBO emphasises that a secure and trusting relationship between guide and guests increases the likelihood that instructions will be followed and that risk communication should be carried out without causing unnecessary concern. Practical training in risk communication is therefore included in the training programme.

The training also covers elements addressing human factors, such as how stress, group dynamics and cognitive biases[29] can influence decision-making. This includes training in identifying and managing situations where risk perception, communication, or group behaviour may affect safety.

Guide responsibility and group management

A recurring focus within the training is the guide's responsibility for managing guests when skiing in off-piste terrain. The guide must, among other things, assess the guests' competence and skill level, which is often done within a limited timeframe and based on field observations. Based on this assessment, the guide should adapt the structure of the tour, the choice of terrain and the order of descent. The training also includes practice in handling difficult situations, such as when guests do not follow instructions or when unforeseen events occur during ongoing guiding.

Instructions, route selection and stopping points

Instructions to guests constitute a central part of the training and include, e.g., route selection, order of descent, communication between the guide and the participants, as well as the choice and use of stopping points. Stopping points are used as a tool to structure the skiing and reduce exposure in avalanche terrain. The guide is trained to select stopping points based on safety and the needs of the group, for example by stopping in safe zones outside potential avalanche paths, in locations with good visibility of the upcoming terrain, ahead of steep or technically demanding sections and at transitions between different types of terrain. At stopping points, instructions are given and new assessments of the prevailing conditions are made.

The training also addresses how frequently stops should be made during skiing. The stops are adapted according to several factors, such as the complexity of the terrain, the group's overall competence and fitness, as well as the weather and snow conditions. In simpler

[29] Cognitive biases – unconscious and systematic errors in thinking that occur when people process and interpret information in their environment.

terrain, the distances between stops can be longer, whereas more complex or hazardous terrain requires more frequent stops.

Experience feedback and incident reporting

As part of its professional quality and safety work, the SBO applies a system for voluntary incident reporting. Guides are encouraged to report incidents to the organisation; such reports can be made anonymously. The reports are reviewed by two appointed individuals bound by confidentiality, with the aim of creating a safe and open reporting environment. The incidents are analysed and used as a basis for developing guidelines, training content and safety procedures. With the reporter's consent, lessons learned may be shared within the organisation in order to contribute to collective experience feedback and development.

1.8.2 Human factors in guided skiing activities

Guided skiing in unprepared terrain involves decision-making and actions that take place in a dynamic environment where several actors interact: the guide, guests and, where applicable, the helicopter pilot or other staff. In such activities, communication group dynamics and other human factors influence how information is perceived, interpreted and translated into practical action.

Conditions and limitations of communication

Communication between the guide and guests is challenging but critical for safety. In practice, communication is often verbal and adapted to the situation. It is influenced by several factors, including:

- language comprehension
- acoustic environment (wind, distance between skiers)
- visibility conditions
- the size and composition of the group
- how well the participants know each other beforehand

Group dynamics and the relevance of experience

In groups where the participants are experienced and familiar with one another, communication may to a greater extent take place implicitly, through established patterns, rather than through explicit instructions.

Such groups may also experience a high degree of security and mutual trust, which is a strength in many contexts, but which may at the same time influence the extent to which risks are articulated or questioned. In such groups, informal structures may also emerge, where the actions of individuals rather than the guide's instructions set the direction for the group.

Decision-making in a dynamic environment

Guiding skiers in off-piste terrain means that risks are constantly changing and the risk assessment may need to be revised rapidly. Decisions are often made progressively, for example during reconnaissance from the helicopter, upon landing and during the actual skiing. The guide makes preliminary decisions during the reconnaissance from the helicopter. These decisions can be reconsidered both upon landing and continuously throughout the descent.

Communication during helicopter transport

During the helicopter flight, communication with the guests is hampered as they are not provided with headphones and a microphone.

Communication is further complicated by the fact that the guide is seated at the front of the helicopter and therefore has a different field of view from the skiers. The guests are often not familiar with the local terrain, which can lead to the guide's information being misinterpreted. For the guide, it can also be difficult to ensure that the information is correctly understood by each skier. At the same time, during the helicopter transport, the guide needs to focus on reconnaissance in order to make a well-informed and qualified risk assessment, which means that their attention cannot be directed towards communication with the skiers.

Simplified instructions as a safety measure

Given the background described above, guides often choose to provide simple and clear instructions, such as "follow the guide's track", which is less likely to be misunderstood - especially if supplemented with instructions regarding, for example, the maximum lateral distance between skiers.

1.8.3 Companion rescue and transceiver search

In avalanche accidents, companion rescue is the first emergency response. It is carried out by individuals present at the scene. Companion rescue involves locating, uncovering and providing initial care to buried persons before organised rescue resources arrive on site. During guided skiing in unprepared terrain, the guide plays a central role in initiating, leading and coordinating rescue operations.

Equipment

The equipment used in companion rescue typically consists of a transceiver, shovel and avalanche probe. There are also avalanche backpacks, with dedicated compartments for quick and easy access to the shovel and probe. In addition, the avalanche backpack is equipped with an airbag which is activated manually. The airbag reduces the risk that a person is completely buried in an avalanche by increasing the likelihood that the person remains closer to the surface of the snow during the avalanche's movement. If a person is buried in an avalanche, certain models of airbags can improve the chances of survival by creating an air pocket around the head. The air pocket increases the time available to be found before oxygen deprivation occurs, thereby improving the chances of survival.

A transceiver is an electronic device worn in a harness on the upper body. It has two operational modes that are switched manually: send and search. In send mode, which is normally used while skiing, it transmits a radio signal on a specific frequency. In search mode, it detects radio signals from transmitting units and, once a signal is detected, provides an audible signal and visual information indicating the distance and direction to the transmitting device.

An avalanche probe is a collapsible rod with distance markings starting from the tip. A common length for the probe is between 240 and 320 centimetres. Organised mountain rescue teams often use longer avalanche probes. The avalanche probe is designed to be pushed down into densely packed snow and it is used to search in close proximity to a person for the direct location of the buried individual.

Equipment such as transceivers, shovels, probes and avalanche backpacks constitutes a central part of the safety concept when skiing in avalanche terrain. For the equipment to have practical significance for safety, it is not only necessary to carry it; users must also be thoroughly familiar with its function, limitations and practical handling. Furthermore, there must be knowledge of systematic search methods or clear guidance in the event of an accident.

Methodology

In companion rescue, time is a critical factor. Established methodology requires those participating in the rescue effort to switch their transceivers to search mode as quickly as possible, while the group simultaneously attempts to establish an initial situational assessment. This includes determining how many people are missing, noting the time of the avalanche and determining a probable search area. If a last seen point can be identified, it is often used as the starting point for the subsequent search. In the literature, this point is referred to as the Last Seen Point (LSP).

When a Last Seen Point is known, the signal search normally begins downstream from this point in the direction of the avalanche's movement. If a clear LSP cannot be established, a systematic signal search is instead carried out over the entire probable search area or over the entire avalanche debris field. For a single searcher, the search can be conducted in a systematic zigzag pattern with approximately 40 metres between turning points. When there are several searchers, they should move parallel to each other along the avalanche debris with a distance of about 40 metres between them and no more than 20 metres to the edge of the avalanche debris.

The width of the search strip is influenced by the characteristics of the transceiver, burial depth, signal orientation, terrain conditions, electromagnetic interference and how the transceiver is handled during the search. Electronic devices such as mobile phones and watches can, if they are close[30], affect the function of the transceiver and thereby complicate or delay the location of buried individuals. As the actual range is adversely affected by these and other factors, the stated range cannot be directly translated into search strip width. [31]

Once a transmitting signal has been detected, the search progresses to the coarse search phase and then to the fine search phase, during which the transceiver is held close to the snow surface. This is followed by a pinpoint probe search to confirm the victim's location before excavation begins.

Companion rescue and transceiver search should be practised regularly and under conditions that are as realistic as possible. The reason is that an actual avalanche rescue takes place under severe time pressure and high stress, often in complex terrain and requires that several steps can be carried out quickly, systematically and in a coordinated manner. Realistic training therefore aims to develop both proficiency in the use of rescue equipment and the ability to execute the entire rescue process under conditions that closely resemble those of an actual avalanche accident.

[30] The distance depends on the transceiver. Guideline according to SVELAV: at least 20 cm in transmit mode; in search mode, all other electronic equipment should be switched off. Any necessary electronic equipment, such as a headlamp, should be kept at a distance of at least 50 cm.

[31] ISSW 2023: Companion Rescue Lane Discipline and Search Strip Width, International Snow Science Workshop, 2023.

Checklist

In many high-risk activities, a waterproof information sheet is distributed, featuring a bullet-point checklist and illustrations outlining procedures for handling a critical situation. An example of such a sheet from Avalanche Canada[32] is shown in figure 22.

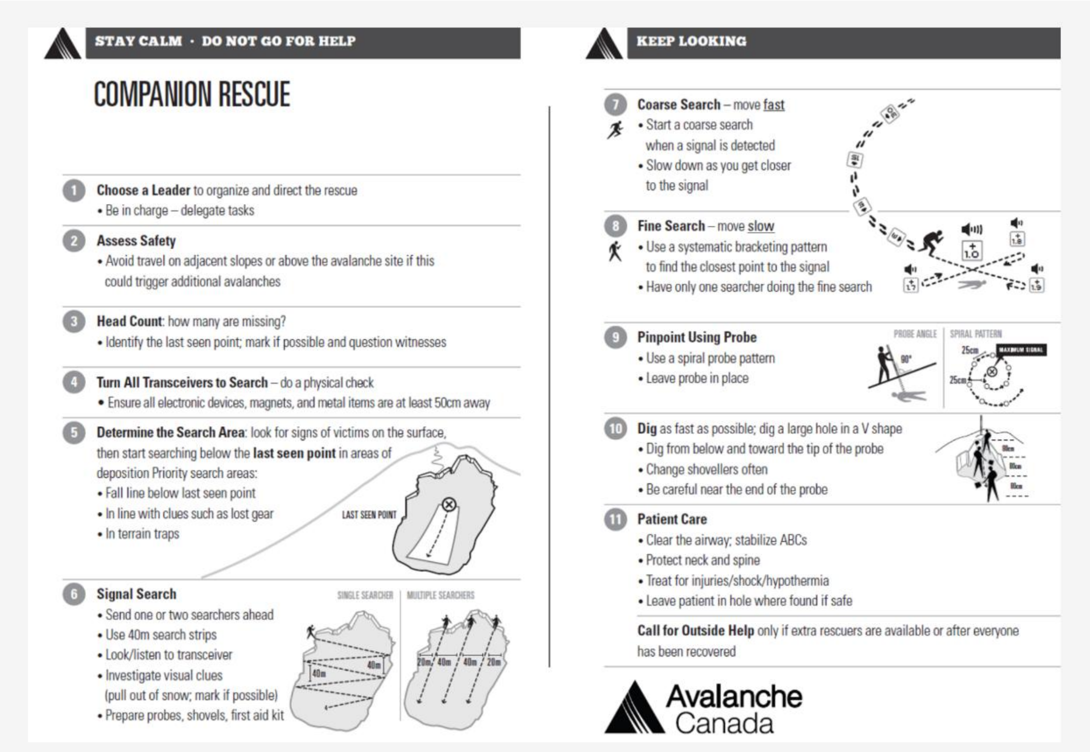


Figure 22. Information sheet on procedures for companion rescue. Source: Avalanche Canada, https://avalanche.ca/./

The information sheet is not intended to replace practice and training, but rather serves as a complement that provides quick, simple and structured guidance on how companion rescue should be carried out. Such information can enable a more effective execution of companion rescue in situations where there is no professional function coordinating the operation, even without prior practical training. Some Canadian heli-skiing operators make this information readily available on their websites, accompanied by details such as how the range and reliability of transceivers are affected by the placement of clothing and other electronic devices.

At Niehku, the routine did not include distributing a checklist as a complement to the safety briefing.

[32] Avalanche Canada - a Canadian non-profit organization working on avalanche safety and information. [Avalanche Canada, https://avalanche.ca/, retrieved February 13, 2026.]

1.8.4 Helicopter transport

During heli-skiing, the helicopter pilot is responsible for ensuring that the flight is conducted safely in accordance with applicable aviation regulations and the operator's certification (AOC[33]). This includes the planning and execution of the flight, selection of landing sites from a flight safety perspective, as well as the assessment of weather and flying conditions.

The pilot is not responsible for the choice of skiing area or the assessment of avalanche risk. In practice, however, there is interaction between the pilot and the guide, particularly during reconnaissance from the helicopter prior to selecting a descent route. Through their vantage point and experience, the pilot may contribute observations regarding terrain, snow conditions and wind effects, which can serve as a complement to the guide's decision-making basis. The operational responsibility for deciding whether to ski in a particular area, however, rests with the guide.

In connection with landing and take-off, the pilot is responsible for the helicopter and the safety in its immediate vicinity. The pilot's role in the subsequent skiing is limited. The pilot usually remains at or near the helicopter and does not participate in guiding or risk management in avalanche terrain.

There is no formal requirement for helicopter pilots operating in heli-skiing to have training in avalanche awareness or companion rescue. At the same time, it is not uncommon for operators to impose such requirements as part of their internal safety procedures.

From the 2026 season onwards, Niehku will require that contracted helicopter pilots have training in avalanche awareness and companion rescue.

1.9 Internal organisation and governance of the operator

1.9.1 Niehku Adventure AB

Niehku Adventure AB (Niehku) operated heli-skiing during the spring and winter season (March–May) from Riksgränsen. The activity was carried out with the assistance of hired guides with extensive experience, all of whom were well known to Niehku, as well as a contracted helicopter company (Kallax Flyg AB). Only IFMGA-certified guides worked with heli-skiing at Niehku. All heli-skiing activities at Niehku were conducted in accordance with the SBO's "Code of Conduct by the Heli-ski Operators within the Swedish Mountain Guides Association".

Upon the guests' arrival, a welcome meeting was held, attended by all participants in the heli-skiing. During the meeting, a general introduction to heli-skiing was provided, along with a specific safety briefing regarding snow, avalanches and procedures for loading and unloading the helicopter.

Avalanche backpacks, transceivers, probes and shovels were distributed and demonstrated. Practical exercises were also conducted at the avalanche search training facility. The procedures to be followed during group skiing under the guide's supervision were also explained.

Each morning and as needed later during the day, a guide meeting was held, attended by the available guides and helicopter pilots. Normally, the operations manager also participated.

[33] AOC – Operating licence in accordance with national regulations and Regulation (EU) 965/2012

The purpose of the meetings was to assess risks, plan the activities and continually monitor the development of weather and avalanche conditions. Meetings were held also on days when heli-skiing was not possible. All meetings were documented in guide meeting minutes, partly to create a decision history.

The planning was based on weather forecasts, avalanche forecasts, webcams and sometimes InfoEx, among other sources. On the day in question, information from the previously mentioned WhatsApp channel was also used in the risk analysis. The risk analysis at the morning meeting was an initial assessment and was largely carried out verbally through discussion and reasoning. The written documentation included the participants, avalanche forecast, weather conditions and number of guests. After the guiding was completed, a summary of the day was also filled in.

If the avalanche risk was deemed too high, or if the weather did not permit flying, the guides arranged alternative activities for the guests. It was always the pilot who made the final decision as to whether the weather allowed for flying. If flying was considered possible, the guests were informed at breakfast. The cooperation between guide and pilot was central and took place as a team, even though pilots and guides were employed by different companies. Deviations from standard procedure could be raised in an open and friendly manner. If situations arose that could not be resolved immediately, these were to be brought to the attention of the operations manager.

1.9.2 The guide

The guide held a valid mountain guide certificate issued by the SBO. He had been an IFMGA-certified mountain guide since 2006 and had worked professionally as a guide since then. He had also regularly undertaken continuing professional development within the mountain guiding profession, as well as concerning CPR and companion rescue.

He had experience guiding international guests and had worked as a guide in, among other places, the Alps, India, Russia, Georgia and Kyrgyzstan. He was very familiar with the area in question and had been skiing in the Riksgränsen area since 1991.

1.9.3 Rescue plan for guides and pilots

Niehku had developed a rescue plan outlining how the guide and pilot should act in the event of an emergency. The initial actions involved gaining an overview of the situation, then alerting SOS Alarm and contacting the mountain rescue service, as well as informing the operations manager. The plan also included a checklist of the information to be provided when raising the alarm.

In the next step, the guide was to ensure that participants were in a safe location, initiate a search operation in the event of an avalanche accident, commence life-saving measures and assist the rescue personnel upon their arrival.

1.9.4 Kallax Flyg AB

Kallax Flyg is one of the largest providers of helicopter services in Sweden and has been in operation since 1998. The company holds a valid Air Operator Certificate (AOC), which includes a safety management system.

The pilot flying at the time of the accident held a commercial licence with current operational authorisation as well as a valid medical certificate. He was the chief pilot at Kallax Flyg and, in addition to the training required for certification, had also completed courses in mountain flying, flying in low-reference environments, heli-skiing and CPR.

There was a valid agreement between Kallax Flyg and Niehku regarding heli-skiing and sightseeing flights. The equipment in the helicopter included, among other things, first aid and emergency kits[34], a mountain equipment bag, satellite phone and snowshoes. In addition to this, Niehku had placed a backpack in the helicopter containing a rope, neck brace and a collapsible stretcher.

The helicopter used on this occasion was a six-seater Airbus Helicopters EC130T2, manufactured in 2018.

1.10 Regulations and supervision

From a legal perspective, heli-skiing can be divided into two main components: helicopter transport and guided skiing.

1.10.1 Applicable provisions

National regulations

Activities aimed at consumers are subject to the Swedish Product Safety Act (2004:451), with the Swedish Consumer Agency as the supervisory authority. All such activities must comply with the general safety requirement set out in Sections 7–12 of the Product Safety Act. According to Section 7, goods and services provided by traders must be safe. Section 8 states that a product or service is considered safe "if, under normal or reasonably foreseeable use and lifespan, it does not entail any risk to human health and safety, or only a low risk. This risk, however, must be acceptable with regard to how the product or service is used and must be consistent with a high level of protection for human health and safety."

When assessing whether a risk associated with a service should be considered acceptable and consistent with a high level of protection, particular consideration must be given to how the service is performed, the safety information provided by the trader, the service's impact on goods, whether it can be assumed that the safety of goods will be affected by the way the service is carried out and any risks the service may entail for certain consumer groups, especially children and the elderly (Section 10).

According to Section 23 of the Product Safety Act, traders must immediately notify the Swedish Consumer Agency if they become aware that a product or service they provide or have provided is dangerous. The trader must also inform the Swedish Consumer Agency of any measures taken to prevent harm. However, according to the Swedish Consumer Agency,

[34] The emergency kit contained equipment such as a shovel, food, a bivvy bag and so on, which could be used if it was not possible to fly back.

it is uncommon for such notifications to be made in relation to services. The Agency has also stated that there is currently an underreporting of such accidents and incidents that are required to be reported under the Product Safety Act, which hampers risk-based supervision.

The Swedish Consumer Agency has the authority to prohibit a service that is deemed dangerous. For example, in 2012, a Finnish operator was prohibited, under penalty of a fine, from providing services on glaciers or in other high mountain terrain in Sweden where there is a particular risk of falling, unless under the supervision of a qualified mountain guide or another guide with equivalent experience and training (injunction dated 5 July 2012, Ref. No. 2011/2043).

The Swedish Consumer Agency has also issued guidance for safe guided mountain tours, as well as general recommendations on glacier safety (although the general recommendations on glacier safety do not cover the terrain in which the accident occurred).

To prevent accidents and share information, there is the Mountain Safety Council (Fjällsäkerhetsrådet), which is coordinated by the Swedish Environmental Protection Agency (Naturvårdsverket) and consists of representatives from organisations and authorities with expertise in mountain safety. The Mountain Safety Council has, among other things, developed the so-called Mountain Leader Standard (fjälledarnormen), an industry standard for the training of mountain leaders.

Heli-skiing is also subject to regulations governing commercial aviation, such as the Aviation Act (2019:500), the Aviation Ordinance (2010:770) and regulations issued by the Swedish Transport Agency.

EU Product Safety Regulation

In December 2024, the EU Product Safety Regulation[35] entered into force. The regulation is directly applicable in Sweden, but as a general rule does not cover services. This means that such services continue to be governed by the Product Safety Act. At present, a legislative process is underway in this area. In a memorandum (Fi 2024:F, November 2025), an expert has analysed the need for supplementary provisions to the Product Safety Regulation. The memorandum proposes new legislation concerning the safety of consumer services, in which it is more clearly prescribed which safety requirements apply to consumer services, which criteria are to be used for assessing safety and the requirements for safety information, preventive measures and so forth. The Swedish Consumer Agency is proposed to remain the supervisory authority, with an essentially unchanged mandate.

The legislative amendments are proposed to enter into force on 1 August 2026.

Workplace safety

The Swedish Work Environment Authority has issued regulations and general guidelines regarding the planning and organisation of work environment management (2023:2). The employer must ensure that there is preparedness and procedures for first aid in the event of accidents and acute illness at every workplace. The level of preparedness required depends on the nature, scope and specific risks of the activity.

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[35] Regulation (EU) 2023/988 on general product safety, amending Regulation (EU) No 1025/2012 and Directive (EU) 2020/1828 and repealing Directive 2001/95/EC and Directive 87/357/EEC.

There are also regulations concerning the design of workplaces (AFS 2023:12), which state that all workplaces must be equipped with adequate first-aid equipment. The equipment must be appropriate to the risks associated with the activity and must be easy to locate and use.

The employer must identify the risks of accidents and assess the potential need for first aid. Based on this, the employer must plan which equipment is needed and ensure that there is access to transport to be able to deal with an accident. Examples of such equipment that may be necessary in a workplace include defibrillators.

1.10.2 Supervisory cases

Following the accident, two authorities initiated supervisory cases. The Swedish Consumer Agency opened a supervisory case against Niehku (Ref. No. 2025/569) concerning the safety of heli-skiing at Niehku and the Swedish Work Environment Authority initiated two supervisory cases: one concerning Niehku (2025/022178) and one concerning Kallax Flyg (2025/022179). All supervisory cases have been closed. The Swedish Consumer Agency has, in its decision, pointed out remaining deficiencies and urged Niehku to take corrective action.

2. Actions taken

2.1 Niehku Adventure AB

Niehku has clarified its procedure regarding communication on the choice of landing site. The pilot and guide must always communicate about where the helicopter is to land at the bottom of the run, something that was not previously established in any procedure.

Niehku also requires that all pilots working in the operation undergo more comprehensive training in snow and avalanche awareness as well as in companion rescue.

The helicopter is now equipped with a backpack containing a shovel, probe and transceiver.

Starting from the 2026 season, Niehku has introduced a procedure to explicitly inform guests about the general risks associated with heli-skiing.

2.2 Swedish Environmental Protection Agency

For 2026, the forecast areas for the Abisko/Riksgränsen mountains can, as of 2026, be divided into two sub-areas.

2.3 Region Norrbotten

The air ambulance service in Region Norrbotten has conducted training exercises for its staff focusing on cold weather and working in avalanche conditions. They have decided to carry out such training annually. The annual physical fitness test has been modified in order to better correspond to the demands of working in mountainous terrain. The purpose is to ensure that those working on the air ambulance have adequate physical condition for the operational profile. Furthermore, treatment guidelines and decision-making protocols for the care of hypothermia patients and avalanche victims have been updated.

The organisation also plans to update its equipment to provide better care in difficult terrain and to improve the measurement of core temperature in hypothermic individuals.

2.4 SOS Alarm Sweden AB

The air ambulance was not activated according to procedure and SOS Alarm has investigated why the routine was not followed. The investigation shows that it was the interpretation of the procedure, as well as shortcomings in communication at the emergency control centre, that caused the alert to be delayed. Furthermore, the investigation reveals that the methodology for positioning during the emergency call was not used and that there was a delay before collaborative partners were involved during the second emergency call. SOS Alarm has taken measures to ensure that a similar situation does not occur again, which include:

- Continuous real-time monitoring
- Targeted training initiatives focusing on communication structure and resource selection in the event of accidents in mountain environments
- Collaboration with Region Norrbotten regarding internal medical management
- Positioning of cases received via 112 calls
- Improved deviation management in cases where activation of collaborative partners is delayed

3. Analysis

3.1 General considerations

Heli-skiing is a commercial activity in which guests seek a unique experience in favourable snow conditions. At the same time, the activity is associated with particular risks, including avalanche danger, difficult terrain and significant distance from public rescue resources. These risks cannot be completely eliminated, but must be managed through planning, ongoing risk assessment and adaptation to current conditions. The organiser is responsible for ensuring that the service is designed and conducted in a manner that limits risks to a level considered acceptable from a safety perspective. In this type of activity, this presupposes continuous risk assessments, clear risk communication and risk-reducing measures.

In the following sections, two main questions are first analysed: *Why was the avalanche triggered?* and *Why did parts of the group end up in the area from which the avalanche could be triggered?* Other factors that contributed to the course of events are then addressed.

3.2 Why was the avalanche triggered?

According to the analysis by the Swedish Environmental Protection Agency, the avalanche was a skier-triggered slab avalanche of the persistent slab type. The triggering mechanism is assessed to have been the load from one or more skiers who affected a weak layer in the snowpack. This type of avalanche can be triggered even from terrain with a slope of less than 30 degrees, if the weak layer is affected in a thinner part of the snowpack, from which the fracture then propagates into steeper terrain.

The guide, skier 2 and skier 5 are considered to have been outside the area from which the avalanche could have been triggered. Nor is it considered possible that the helicopter could have affected the snowpack in such a way as to trigger the avalanche.

The investigation has shown that skiers 3 and 4, just before the avalanche occurred, were situated below the steep slope on the open snowfield. The most probable scenario is therefore that the avalanche was triggered when the load from one or both of these skiers affected the weak layer in an area where the snowpack was sufficiently thin.

3.3 Why did part of the group end up in the area from which the avalanche could be triggered?

Guided skiing in unprepared terrain often involves skiing in or adjacent to avalanche terrain. The guide’s risk management is aimed, among other things, at limiting the skiers’ exposure and reducing the risk of an avalanche being triggered. In the situation at hand, the need for detailed instructions, close supervision and additional safety barriers was assessed as limited. Consequently, the safety margins came, to a greater extent, to rely on the group’s ability to follow the given instructions.

In the steep slope and in the eastern upper corner of the avalanche terrain – where the metre-deep fracture line later formed – the guide tested the snow stability by pressing down on a snow drift with his skis. As the snowpack was several metres thick at that location, the deep weak layer was not affected by the test. Consequently, the risk of a persistent slab could not be identified. The test primarily provided information about the stability of the upper snowpack and was therefore mainly relevant for assessing wind slab formation, which was also the avalanche problem indicated in the forecast.

After the test, the guide and subsequently skier 2 turned to the left, thus moving away from the open terrain. The left turn was part of the risk reduction measures the guide implemented at the site. Having tested the snow stability without observing any snow release, he assessed that the avalanche risk associated with the forecasted wind slab was manageable. Nevertheless, he chose not to continue out onto the open snowfield west of the track, instead steering the descent away from the snowfield and away from the helicopter. This route choice thus provided a safety margin in relation to the avalanche terrain and the remaining uncertainty in the assessment of the snowpack. However, this safety margin was dependent on the group noticing the change in direction and on the first skier following the guide’s track, as well as the subsequent skiers in turn following the tracks of the skier in front of them.

When the other skiers entered the steep slope, they were spread out approximately 15 metres apart laterally, as well as lengthwise. This likely reduced their ability to see the tracks of those ahead. Three of the skiers ended up far to the side, to the west of the guide’s track. As a result, they entered the snowfield and thus the avalanche terrain.

A number of factors are considered to have contributed to the course of events:

- the group’s previous experience
- the communication between the guide and the skiers
- the absence of a common stopping point at the steep slope
- the available visual reference points.

These and other aspects that influenced the subsequent course of events will be addressed in greater detail in the following sections.

3.3.1 Communication – a critical aspect of guiding

The mountain guide training provides fundamental knowledge and procedures for conducting guided skiing in unprepared terrain in a risk-minimising manner. The training covers, among other things, risk assessment, communication, group management, route selection, stopping points and situational adaptation. A central element is the interaction between guide and skier, where safety largely depends on instructions being clear, understood by the group and adapted to the specific terrain and risk scenario.

The guide chose a route that minimised exposure to avalanche terrain. In the sections that traversed avalanche terrain, the risk was to be managed by having the skiers follow the guide's track. Additionally, they were to ski with intervals between them to avoid the entire group being exposed to avalanche risk simultaneously. The guide and skier 2 carried out the traverse in this manner. However, the outcome was that both were nonetheless caught up in the snow masses.

The risk assessment that was carried out was not communicated to the skiers. Prior to the final run, the guide did not give the skiers any specific instructions on how the descent should be executed, on which side of or at what maximum distance from his track they should ski, or regarding the known risks present. He assumed that the skiers would follow his track according to previous instructions and considered that the instruction "follow my track" was sufficiently clear. Interviews with the surviving skiers reveal that they had not reflected in detail on the meaning of this instruction, nor were they aware that any deviation from the guide's track could result in increased exposure to avalanche terrain.

The fact that the guide did not clearly inform the skiers about known or potential risks, but instead assumed that these would be avoided by following his track, meant that the participants were to a greater extent left to interpret the risk situation based on their own knowledge and experience. As the previous runs had been perceived as short, gentle and risk-free and had been completed without incident, the impression among the skiers that the terrain was relatively safe was reinforced.

This highlights the importance of open and clear risk communication, especially in groups with a high level of experience. When participants are given insight into the background of the guide's risk assessments and route choices, their understanding of the instructions provided increases – for example, why it is crucial in certain situations to strictly follow the guide's track. Such communication strengthens both situational awareness and the ability to identify and resolve misunderstandings before they have serious consequences.

Against this background, Niehku should take measures to strengthen risk communication to guests, with the aim of increasing understanding of how guided skiing in unprepared terrain should be carried out safely.

The mountain guide training already includes components that highlight the importance of open and clear risk communication. However, the investigation shows that this issue requires continued attention, particularly in operations involving experienced guests and complex terrain.

SBO has stated that the incident will be addressed within the organisation's established incident analysis procedures and experience feedback processes. SHK considers this an appropriate approach to capture and disseminate the lessons learned from the accident, especially regarding how risk communication to experienced guests can be put into practice when guiding in avalanche terrain.

The Swedish Mountain Guide Association is therefore recommended, within the framework of its activities, to address the incident with particular emphasis on the importance of clear and needs-adapted risk communication.

3.3.2 The importance of stopping points at critical terrain transitions

Mountain guides are trained to use stopping points as a mean to structure the descent, reduce exposure to avalanche terrain and adapt route choices according to the group's needs and the difficulty of the terrain. Stopping points can also be an effective means of managing situations where different perceptions regarding risk and route selection have arisen.

The training emphasises both where stopping points should be placed and what they should be used for. Stops should, for example, be located in safe zones outside potential avalanche paths, in places that offer a good overview of the upcoming terrain, as well as before steeper or more technically demanding sections and at transitions between different types of terrain. The purpose is to create opportunities for the guide to maintain control over the group's movement, provide new instructions and, if necessary, revise the risk assessment based on the terrain ahead.

The training material does not specify how frequently stops should be made, nor the number of stops. Instead, it states that the stops should be adapted to the complexity of the terrain, the length of the runs, the group's collective competence and fitness, as well as the weather and snow conditions. In simpler and flatter terrain, the distance between stops can therefore be longer than in more complex or hazardous terrain.

The runs in question during the day were short and predominantly gentle. The group consisted of experienced skiers with previous heli-skiing experience and the initial runs had been completed without deviations or incidents. Against this background, the guide assessed the need for frequent stops as low. Such an assessment is consistent with how stop frequency is often adapted in the industry for shorter runs in easier terrain and with competent groups. At the same time, such an approach can result in underestimating the need for a specific stopping point at a critical terrain transition.

The particular steep slope represented a clear terrain transition with an increased risk of alternative route choices. During the final run, the guide placed a stop in connection with the change of direction made before the new line. However, at this stop, no further detailed instructions were given on how the run should be conducted in the subsequent section, for example regarding the order of descent, stopping point at the steep slope, or how the skiers should relate to the guide's track through the terrain transition.

The guide had not identified the risk that the group might deviate from his track and instead focused on the avalanche danger at the steep slope. He tested the snow stability but did not observe any snow release. This reinforced the guide's perception that the avalanche risk was manageable. These factors, together with the experiences from the previous runs, contributed to the guide not gathering the group in connection with the steep slope.

The incident demonstrates that the need for stopping points in avalanche terrain should not be assessed solely on the basis of the length of the run, the group's fitness, or the skiers' technical ability. At critical terrain transitions, a stopping point can serve as an important safety barrier by ensuring the route choice, reducing the group's dispersion and clarifying how the descent should be carried out. In the incident in question, the absence of such a stopping point meant that an opportunity to address the lateral dispersion that had arisen before the steep slope was not used.

3.3.3 Visual reference points may have drawn the skiers' attention

In environments with complex terrain, it is common for skiers to navigate using the most prominent visual reference points, such as tracks in the snow, a helicopter, an open snowfield, or a person further ahead. When a group spreads out laterally, skiers towards the back increasingly tend to follow the tracks of the skier immediately in front of them, rather than those of the guide. This means that if a skier ahead deviates from the guide's line, this deviation can also influence those who follow, as the guide's track then becomes less clear as a common reference. If there are also open snowfields or other prominent features in the direction of travel, these may become reference points that can influence route choice. This is particularly true if the risk associated with deviating from the guide's track is perceived as low.

In the accident in question, there were several visual reference points that may have competed with the guide's and the preceding skiers' tracks in the snow; for example, the helicopter and open snowfields with untouched snow. When the guide and skier 2 traversed towards the narrow strip of woodland, their position may also have served as a reference point for the skiers behind them.

The helicopter's position

The helicopter was parked on a flat, snow-free area far to the right, in the direction of travel, from the planned descent. The pilot chose this location partly to avoid landing directly below a run and partly to ensure a safe landing and efficient pick-up. Since suitable landing sites were limited in the area, a location deemed safe and practical was chosen, even though this meant a longer traverse for the group to reach the helicopter.

The pilot had no training in avalanche assessment and was not involved in the risk analysis and terrain evaluation that formed the basis of the guide's planning for the run. The pilot was therefore not in a position to assess avalanche risks independently. The chosen pick-up location meant that the lower part of the planned run had to be routed through a runout zone in order for the group to reach the helicopter. In other words, the choice of location affected the group's exposure to avalanche terrain, but this was beyond what the pilot was in a position to assess.

There was no established procedure requiring the guide and pilot to always coordinate the exact pick-up location, although this was often done in practice. In this case, the landing site was not communicated in advance between the guide and the pilot.

When the skiers reached the steep slope, the helicopter became visible further down, to the right in the direction of travel. As the helicopter could be perceived as the end point of the run, it may have influenced the skiers' orientation and choice of route.

Measures taken and remaining risks regarding visual reference points

Following the accident, Niehku has changed its procedures so that the guide and pilot always coordinate the choice of pick-up location. This reduces the risk of the helicopter being situated in avalanche terrain and of the helicopter's location causing skiers to be exposed to avalanche terrain as they make their way to the pick-up point. The measure thus reduces the risk specifically associated with the placement of the helicopter. However, it does not eliminate the risk that other visual reference points in the terrain may influence the skiers' choice of route. It is therefore important that Niehku also addresses these issues in the planning of activities and in risk communication to guests.

A planning document in which possible runs, drop-off points, pick-up points and flight paths are mapped out in advance can serve as a support to reduce uncertainties in planning and to coordinate guide and pilot. Such a tool does not replace ongoing risk assessment in the field, but could serve as a complement to the newly introduced routine.

3.4 Improved avalanche forecasts contribute to safety in the field

The avalanche forecast for the area was one of several sources used in the planning and execution of the heli-skiing activities. At the same time, the forecast area covered a very large geographical region, where weather and snow conditions can vary considerably between different valleys, altitudes and aspects. This means that the forecast was, by its nature, general and could not provide detailed information about local conditions on individual slopes. The accuracy of the forecasts is also affected by the observations available from the area.

The avalanche forecast for the day identified wind slabs as the current avalanche problem. However, the avalanche that occurred is assessed to have been of the persistent slab type. This is a type of avalanche that is particularly difficult to identify in the field and which often lacks clear warning signs.

If the forecasters are aware of the risk of persistent slabs, they can highlight particularly sensitive types of terrain or specific points with elevated risk. According to information from interviewed guides, they generally pay special attention to the risk of persistent slabs and avoid such areas when planning the skiing. The fact that the forecast did not highlight this avalanche problem may therefore have contributed to the guide's attention – both in the risk analysis prior to skiing and during the subsequent guiding – being more strongly focused on the forecasted avalanche problem.

The ability of the forecasters to detect the risk of persistent slabs was affected by the size of the forecast area. To improve the accuracy of the forecasts, the Swedish Environmental Protection Agency has, starting from the 2026 season, introduced a division of the forecast area in the Abisko/Riksgränsen[36] mountains into smaller sub-areas.

Even with the new, more detailed avalanche forecasts, limitations remain and the forecasts cannot provide a comprehensive picture of the actual avalanche problems. Guides are generally aware of these limitations and do not use the forecast as the sole source in their

[36] From the 2026 season onwards, the Southern Jämtland Mountains area may also be divided into smaller sub-areas.

risk analyses. Instead, they base their decisions largely on their own observations, experience and local assessments.

To further improve the quality of the forecasts, a broader knowledge base is required. One way to achieve this is to make use of field observations, for example by having guides and other stakeholders – when conditions allow – report their observations into a shared system. Although this is resource-intensive, it can, in the long run, benefit all parties: the forecasters receive a more extensive basis for their work and users of the forecasts can obtain better support for their risk analyses, thereby reducing uncertainty when planning their activities. In Sweden, digital tools already exist for sharing avalanche observations, such as InfoEx, which can serve as such a channel.

3.5 Efficient companion rescue can save lives

3.5.1 Sequence of events and execution of companion rescue

After the avalanche, the group was scattered over a large area. Two skiers had been completely buried by the snow masses. The remaining skiers lacked visual contact with one another and were also affected by shock and disorientation. The guide, who is meant to serve as the central function in companion rescue, was swept along by the avalanche and injured and was therefore initially unable to coordinate the operation or provide instructions to the others.

The terrain and the extent of the avalanche cone made it difficult for the group to gain an overview of the situation and to communicate with one another. The pilot lacked both avalanche equipment and training in companion rescue, which meant that he could not participate effectively in the search. Only after some time was the guide able to contribute to the coordination by providing information to the other skiers on the direction shown by his transceiver.

3.5.2 Challenges and lessons learned

The ability to carry out effective companion rescue requires that at least one person is proficient and possesses sound knowledge and skills in all aspects of companion rescue and is able to lead and coordinate the others on site. It is also assumed that the remaining participants have sufficient knowledge and proficiency in the use of the equipment and in the procedures for the different stages of companion rescue, in order to effectively participate in the operation.

The incident highlights how time-critical actions can be delayed when the coordinating function – i.e. the guide – is himself affected by the avalanche. This creates a particular vulnerability when there is only one person with sound knowledge of companion rescue. If this resource is lost, the companion rescue becomes ineffective, which significantly reduces the chances of survival for those affected.

In this accident, it took approximately 30 minutes to locate the individuals who had been buried under the snow. It then took a further 10 minutes or so to dig them out and during the excavation of skier 4, the work was complicated by an arm being trapped in a pole strap.

Safety-critical information must be communicated clearly and adapted to the participants' actual abilities, as this can be decisive in the outcome of an avalanche accident. The skiers were experienced and had received a safety briefing and instructions on how to use the avalanche equipment. Despite this, they found it difficult to initiate an effective companion rescue without coordination. A simple and clear checklist can be a valuable support in stressful situations, as it provides a fixed structure for actions even when participants are under pressure or lack an overview. By quickly reminding participants of key steps and priorities, the risk of overlooking crucial elements is reduced. This can create better conditions for effective companion rescue, especially in cases where coordination and clarity are critical to the outcome.

Following the accident, Niehku has taken measures to reduce the identified vulnerability in companion rescue. Niehku has introduced a requirement that contracted helicopter pilots must be trained in companion rescue and that helicopters must be equipped with avalanche equipment. In addition, Niehku has introduced a procedure whereby participants must confirm that they have received and understood information about companion rescue. In light of the measures that have been taken, SHK issues no recommendation in this regard.

3.6 Regulations

3.6.1 Safety of consumer services

Swedish legislation does not regulate in detail the execution of high-risk consumer services, such as heli-skiing. Instead, the legislation adopts an overarching approach and leaves it to the service providers to design their services in such a way that they meet the safety requirements. As there is no continuous supervision, it is only when something has gone wrong that it becomes clear to outsiders that the service provided did not meet the safety standards.

This type of regulatory framework places significant demands on those providing a service to identify and manage the risks involved. In many cases, there are industry organisations that develop more detailed rules and establish best practices.

It is not appropriate to pursue detailed regulation for every types of service offered on the Swedish market. However, this incident demonstrates that there may be reason to strengthen the information provided to service operators who offer services that may entail particular risks.

For the Swedish Consumer Agency to obtain relevant information about which activities are particularly high-risk, it is important that operators report incidents and accidents – something that is not done to a sufficient extent today, despite it being an obligation under the Product Safety Act.

Against this background, there may be reason for the Swedish Consumer Agency to take measures to raise awareness. However, since legislative work concerning the safety of consumer services is currently underway, no recommendation is made in this regard.

3.6.2 Safety at workplaces

In heli-skiing, the helicopter and the mountain environment are to be regarded as workplaces for the pilot and guide.

The employer is responsible for ensuring that each workplace has preparedness and procedures for first aid, adapted to the nature, scope and specific risks of the operation. When working in extremely remote areas, the employer must take into account both the risk of an accident occurring and the potential delay before rescue resources can arrive. This means that the requirements for first aid training and access to appropriate equipment are particularly important in such environments. The chances of survival increase significantly if CPR is initiated and a defibrillator is used within the first few minutes following a cardiac arrest. One way to improve access to defibrillators in extremely remote areas is to equip the helicopters – which also serve as workplaces – with such equipment.

The Swedish Work Environment Authority should therefore investigate the need to clarify the requirements for first aid equipment for operations involving particular risks, conducted in extremely remote areas.

3.7 Analysis of the rescue operation

The accident occurred in an extremely remote area where emergency resources are limited and from which the distance to the nearest rescue unit is almost always long, something that became evident during the rescue operation.

SOS Alarm had difficulties locating the accident site. The ambulance helicopter was dispatched late and there were shortcomings in how the mountain rescue operation was led and coordinated. SHK will therefore consider in greater depth:

- Dispatch procedures
- Care of the casualties
- Coordination and incident command of the operation

3.7.1 Dispatch procedures

Emergency call to SOS Alarm

The first call to SOS Alarm came from the operations manager at Niehku. He reported that an avalanche accident had occurred in Kårsavagge in connection with heli-skiing but was unable to provide the exact co-ordinates of the accident. SOS Alarm and the other parties who were monitoring the call actively worked to try to pinpoint the exact accident site, but this took time.

SOS Alarm has extensive capabilities to locate an accident site. A prerequisite for doing so more easily is that a person close to the accident makes the emergency call. It took seven minutes from SOS Alarm receiving the emergency call until they requested the pilot's mobile number and a further three minutes until they called him. Through the call with the pilot, i.e. fifteen minutes after the first emergency call, SOS Alarm was able to determine the exact location of the accident.

SOS Alarm were informed that a helicopter was involved in the accident. However, neither SOS Alarm nor JRCC used this information to help locate the accident. The information could, for example, have been used to track the helicopter's flight path.

In this case, the delay in determining the exact position did not postpone the operation, as the dispatched resources were already heading toward the approximate location. However, it is crucial that rescue resources receive information about the exact accident site as soon as possible to ensure the most effective rescue operation.

SOS Alarm has conducted its own investigation into why it took time to locate the accident site. As a result, SOS Alarm has updated its training for emergency call operators regarding location identification in challenging environments such as mountainous terrain and at sea.

Dispatch of rescue resources

The dispatch of all rescue resources, except for the air ambulance helicopter, was carried out according to the emergency response plan for resource deployment and without delay. The reason the ambulance helicopter was not initially dispatched was that several other helicopters were already en route to the accident site and it was therefore assessed unnecessary. However, by coincidence, the ambulance helicopter did receive the alert and was thus able to contribute to the operation.

In challenging terrain such as mountainous environments, access to helicopters is often crucial for the outcome of the operation. The fact that several helicopters had already been alerted does not constitute sufficient justification for refraining from alerting additional helicopters, as each helicopter has different capabilities and thus serves different purposes during a rescue mission. The air ambulance helicopter in Gällivare was not engaged in other assignments and had a relatively short flight distance to the accident site. Had the air ambulance helicopter been alerted earlier and landed directly at the site where the skiers had been dug out, medical intervention could have commenced approximately an hour earlier than what actually occurred.

It was a deliberate decision not to alert the air ambulance helicopter in the initial phase, i.e. a deviation from the alert plan. Initially, it can be difficult to gain an overview of the accident and to assess the extent of resources required. SOS Alarm does not have a routine for ensuring that the alert plan is followed up. A routine that ensures that initial decisions are reviewed would provide the SOS operator with a better basis for assessing whether the appropriate resources have been deployed. SOS Alarm should therefore review its procedures for following up alert plans to ensure that the correct resources reach the accident site.

3.7.2 Care of the causalities

Survival aspects

The skiers who were buried under the snow were located at 16:17, approximately 30 minutes after the avalanche was triggered. When they were dug out, ten minutes later, they showed no signs of life. The other skiers, the guide and the pilot initiated CPR. When defibrillators were attached to the skiers, no shockable electrical activity could be detected in their hearts.

Based on the available investigative material, it is assessed that the outcome for the skiers could not have been influenced by either CPR or the use of a defibrillator, as it is assessed that they were in asystole when they were dug out. Despite this assessment, SHK has examined the execution of the operation more closely to identify possible safety improvements.

Execution of the rescue operation

The mountain rescuers who were training in Abisko proceeded directly to the accident site. The fact that they were gathered in Abisko meant that they were able to head towards Kårsavagge without delay when they received the alert.

The mountain rescuers lacked personal identification badge/patch and were dressed in civilian clothing at the accident site, which made it difficult for cooperating actors to understand who they were. The decision not to bring the assigned identification was a deliberate choice made to save time and reach the accident site more quickly. Wearing identification is important to enable cooperating parties to understand who is acting at the scene of an accident. To ensure it is always available, identification should be brought along during exercises, so that those responding to an alarm can take it with them without causing any delay to the operation.

Furthermore, the mountain rescuers did not bring a defibrillator. According to the incident site officer, they only bring a defibrillator to incidents where it is indicated that the affected person is experiencing chest pain. However, the Police state that, according to the methodological guidelines for police mountain rescue, a defibrillator should always be brought when responding to an alert. In avalanche accidents where a person buried in the avalanche does not first suffocate, but instead is first cooled down and subsequently suffers from oxygen deprivation, a defibrillator can affect the outcome. Hypothermia can potentially protect the brain, making resuscitation possible when the person is rewarmed. As there has been some uncertainty regarding when defibrillators should be brought along, SHK recommends that the Police Authority clarify its procedural guidelines to ensure that assigned equipment, such as defibrillators and identification, is taken to the accident site.

3.7.3 Coordination and management of the operation

Incident command of complex operations

Both the police and the municipal fire and rescue service in Kiruna initiated rescue operations under the Civil Protection Act shortly after the alarm was received. The municipal fire and rescue service concluded its rescue operation under the Civil Protection Act after just over an hour but continued to assist the police with the resources already deployed in the operation. The Swedish Maritime Administration did not initiate a rescue operation under the Civil Protection Act, but assisted the police in their operation. SHK has found no reason to further review the management of the municipal fire and rescue service or the Swedish Maritime Administration.

Regarding the police's initiation of the rescue operation under the Civil Protection Act, they followed their procedures and appointed both an incident commander and an incident site officer from the mountain rescue service. The accident site spanned a large area with difficult terrain, which made it difficult both to reach the site and to maintain radio coverage during the operation. The poor weather also made access more difficult. Several different rescue resources participated in the rescue work, both on the ground and in the air. The challenging terrain and the large number of rescue resources involved made the operation complex, requiring the incident command to manage a large number of tasks simultaneously.

Incident site officers from the mountain rescue team undergo limited training compared to the training provided to police officers who are expected to lead complex operations. For this type of operation, there is a need to coordinate what the involved actors are doing and should do, so that the right actions are taken at the right time. For example, the ambulance helicopter needed to know where skiers 3 and 4 were located once they had been dug out, so that the helicopter could land in the correct place and begin the medical response sooner. This would have required clear situation reports from the site and tactical plans for how the work should be carried out.

There was no one who developed a comprehensive situational overview and communicated it to the rescue actors. The positions of the persons who had been dug out were not communicated to the rescue resources on their way to the accident site. If a comprehensive situational overview with relevant information had been communicated, the ambulance helicopter could have landed where the dug-out individuals actually were. This would have allowed the medical response to begin approximately 30 minutes earlier. The lack of a communicated comprehensive situational overview can partly be explained by the fact that the incident site officer from the mountain rescue service had extensive responsibilities and was forced to handle many simultaneous tasks, with a focus on leading the mountain rescue team. This meant that the incident site officer was not able to prioritise establishing and communicating a consolidated situational overview. Nor did anyone else take the initiative to coordinate the joint management among the involved actors.

The police have substantial resources for managing complex operations. In this operation, however, the police largely relied on the incident site officer from the mountain rescue service. The limitations in the mountain rescue team's capabilities in this regard resulted in shortcomings in, among other things, coordination, which significantly complicated the rescue operation. Given the complexity of the operation, in relation to the mountain rescuers' training and experience in leading large-scale operations, there is reason to review the police's ability to lead complex rescue operations under the Civil Protection Act in mountain areas. Mountain rescue operations, where many rescue actors need to cooperate, are by nature complex and require special competence and experience. Responses to accidents that initially appear minor and straightforward can quickly become complex. Developing the habit of promptly deploying additional command resources and adapting command capability even in small and simple incidents provides experience and the ability to do so when dealing with situations where command work becomes truly challenging.

In light of the above, the Police Authority should review the possibility of strengthening incident command capabilities during complex operations in mountain environments. The purpose of the review should be to create more effective management and strengthen joint handling among actors during mountain rescue operations. In this type of accident, several parallel rescue operations under the Civil Protection Act as well as a medical response are often ongoing simultaneously. To achieve the objective, the review should therefore be conducted together with the actors with whom the Police Authority is expected to cooperate in managing accidents in mountain environments.

Challenges in radio communication

During the rescue operation, there were three shortcomings related to radio communication: lack of clarity in the communication plan, areas with no Rakel network coverage and lack of radio discipline. SHK comments on these issues in more detail below.

Depending on which actors participate in a rescue operation under the Civil Protection Act, different structures for radio communication are required. SOS Alarm assigned talk groups for the rescue operation according to standard procedure. However, the operation was complex and involved many actors who needed to cooperate. Communication took place on different talk groups and it was never clearly stated by the incident command which talk groups should be used. The operation never established a functioning communication plan and these difficulties formed the basis for communication problems that persisted throughout the operation. SOS Alarm has taken measures to strengthen knowledge regarding how communication plans should be created.

In addition to deficiencies in the communication plan, there was also a lack of coverage in the Rakel network at the accident site. This too complicated communication between the actors at the scene and the command centres. For cooperation to be effective and for society to jointly manage accidents, it is crucial that the actors can communicate with each other during rescue operations. In light of the radio communication challenges encountered during the rescue operation, the Swedish Civil Defence and Resilience Agency should ensure that critical societal actors can communicate in extremely remote areas in the development of Rakel G2.

What further complicated the operation were shortcomings in radio discipline. In this operation, there were deficiencies both regarding which talk groups were used and what information was shared in the talk groups. The mountain rescue service communicated through calls to individuals and almost all communication took place on the joint cooperation talk group. For communication to be effective and appropriate, calls need to be made to functions rather than individuals. Information relevant to all involved actors should be shared on the cooperation talk group. Actor-specific information should be communicated on internal talk groups. In view of the identified shortcomings in radio discipline, the Police Authority should strengthen efforts regarding radio discipline and the application of pre-planned communication plans during mountain rescue operations involving multiple actors.

3.8 Overall assessment

Guided activities in unprepared terrain is a type of operation in which safety largely depends on the effective interplay of several elements of risk management. This requires a constantly active and conscious approach to communication, risk awareness, professional judgement and situational adaptation. The Swedish Mountain Guide Association’s (SBO) guidelines and training objectives already cover the central aspects of safe guiding in avalanche terrain, such as risk assessment, communication, stopping points, group management and situational adaptation. It is therefore of great importance that guides and organisers continuously reflect on and reinforce these areas, even when previous experience and the competence of the group create a sense of security.

The investigation shows that Niehku had an established approach for planning and risk assessment. This was based, among other things, on daily guide meetings, weather and avalanche information, the exchange of experience between guides and pilot, the industry’s risk management practices for off-piste skiing and the guides’ local knowledge. The guide in question had extensive experience and excellent local knowledge. A risk analysis had been conducted prior to the skiing and risks were then assessed continuously throughout the day. However, given the data used, it was not possible in the risk analysis to identify the actual avalanche problem. The guide reduced the initial uncertainties by starting the day’s skiing in easier terrain and then gradually moving the activity towards somewhat more challenging areas. In this way, he was able to assess the snow conditions, visibility, wind effects, the group’s skill level and the skiers’ compliance.

The fact that the avalanche forecast did not highlight the actual avalanche problem may have influenced the guide’s focus during the risk analysis and subsequent guiding. The guide was not in a position to identify the actual avalanche problem in the field. Despite conducting snow stability tests, there were hidden risks within the snowpack that could not be detected using the available methods.

The guide's assessment of the group's competence and compliance, combined with the fact that previous runs had been completed without incident, contributed to the belief that the instruction to follow the guide's track was sufficient. At the same time, the guests had experience from larger mountains and perceived the current runs as short and gentle, which may have led them to view the skiing as less risky. This resulted in a false sense of security for both the guide and the guests, albeit for somewhat different reasons.

The guide's risk analysis was based on the assumption that the group would follow his track and the chosen route provided a safety margin as long as this condition was met. What only became clear in hindsight was that this condition was not sufficiently robust in the particular terrain transition. The actual avalanche problem was difficult to identify in the field and at the same time, several factors could have made it harder for the skiers to perceive and follow the guide's track: the lateral dispersion within the group, the limited visibility over the steep slope, the chosen pick-up location and other visual reference points in the terrain.

Considering the course of events as a whole, the risk communication to the group and the instructions regarding how the skiers should relate to the guide's track appear less clear than the situation may have required. A joint gathering in connection with the terrain transition could have mitigated these vulnerabilities by clarifying the route choice and the importance of following the guide's track. In the present situation, such a gathering appears to have been the last possible safety barrier before the group entered the part of the run where the choice of route directly affected exposure to avalanche terrain.

There was not one single cause that led to the accident, but rather several interacting factors: the limited risk communication, the simplified instructions regarding how the skiers should relate to the guide's track, the fact that previous runs had been completed without incident and thus may have contributed to both the guide and the guests perceiving the skiing as less risky, as well as competing visual reference points in the terrain – including the position of the helicopter and the open snowfields – which influenced the choice of route and finally the gathering before or in connection with the terrain transition. Together, these factors contributed to the group ending up in avalanche terrain.

This highlights that safety in complex terrain environments relies on the interplay between instructions, communication and the group's actual movement patterns. When these are not fully coordinated, safety margins can gradually diminish without this being noticed.

The companion rescue brought to light a known vulnerability in this type of activity, namely that practical rescue capability is largely tied to the guide, who may himself be affected in an avalanche. When the group became dispersed and the guide was injured, the coordination of the companion rescue was delayed, which meant that the entire operation took longer and was less effective.

In the incident in question, the pilot was able to assist in the search efforts and later in performing CPR, but he lacked avalanche equipment and training in companion rescue. Following the accident, Niehku has introduced a measure to reduce this vulnerability. If the pilot has training in companion rescue and avalanche awareness, as well as the appropriate equipment, the pilot – should the avalanche occur in the vicinity of the helicopter – can assume a coordinating role in the companion rescue if the guide is incapacitated. However, such support is situation-dependent and cannot be assumed to be available in every operation.

The rescue operation was hampered by insufficient radio coverage, unclear communication plans and the absence of a consolidated situational overview. This contributed to delays and made it difficult to quickly locate and attend to the casualties. Moreover, these shortcomings reinforced one another as the operation progressed. These experiences demonstrate that procedures for communication and command during operations in mountain environments need to be developed and clarified in order to increase efficiency and reduce time losses in the event of serious accidents.

4. Conclusions

4.1 Investigation results

a) The guide held a valid international mountain guide certificate of the IFMGA type.
b) The guide had experience of the area.
c) The guide had experience guiding international guests.
d) An initial risk analysis had been conducted at a morning meeting, primarily verbally and through discussion and reasoning. The risks were then continuously assessed throughout the day.
e) Information regarding risk analysis and avalanche danger was not shared with the guests.
f) The avalanche forecast indicated an avalanche danger level of 3 on a five-point scale.
g) The avalanche problem was identified as wind slabs.
h) The skiing took place in and adjacent to avalanche terrain.
i) The skiers had not received detailed instructions on how the descent was to be conducted.
j) There was no communication between the guide and the pilot regarding the pick-up location.
k) The position of the helicopter might have influenced the group's choice of route.
l) Part of the group ended up off the guide's track and in an area where a persistent slab avalanche could be triggered.
m) A large persistent slab avalanche was triggered.
n) The data and methods used in the risk analysis did not provide the means necessary to identify the actual avalanche problem.
o) The avalanche is assessed to have been skier-triggered.
p) The alarm was raised to SOS Alarm 5 minutes after the avalanche occurred.
q) The air ambulance was activated 30 minutes after the alarm was received.
r) Coordination between the actors involved in the rescue operation was not comprehensive.

4.2 Causes of the accident

During guided skiing in unprepared terrain, an avalanche of the type persistent slab was triggered and the following interacting factors contributed to the accident:

- The skiing was carried out adjacent to and inside of, avalanche terrain.
- Parts of the group ended up in an area from which the avalanche could be triggered.
- The skiers had not received detailed information on how the descent should be carried out.
- The guide presumed that the skiers would follow his tracks.
- Avalanche problems of the persistent slab type are difficult to identify.
- A false sense of security led to the risks being underestimated.

Since the guide was caught in the avalanche, he was unable to immediately lead and coordinate the companion rescue, which delayed the location of the missing persons.

5. Safety recommendations

Niehku Adventure AB is recommended to:

- strengthen risk communication to guests in order to increase the understanding of how guided skiing in unprepared terrain should be carried out safely (see section 3.3.1*) (SHK 2026:07 R1)*

The Swedish Mountain Guide Association (SBO) is recommended to:

- within the scope of its work, highlight the accident with particular emphasis on the importance of clear and needs-adapted risk communication (see section 3.3.1) *(SHK 2026:07 R2)*

The Swedish Work Environment Authority is recommended to:

- investigate the need to clarify the requirements for first aid equipment for activities involving particular risks, which are conducted in extremely remote areas (see section 3.6.2) (*SHK 2026:07 R3)*

The Swedish Police Authority is recommended to:

- clarify its methodological guidelines to ensure that assigned equipment, such as defibrillators and identification, is brought to the accident site (see section 3.7.2) *(SHK 2026:07 R4)*

- review the possibility of strengthening command capabilities during complex operations in mountain environments (see section 3.7.3) *(SHK 2026:07 R5)*

- strengthen its efforts regarding radio discipline and the application of pre-planned communication plans during mountain rescue operations involving multiple actors (see section 3.7.3) *(SHK 2026:07 R6)*

The Swedish Civil Defence and Resilience Agency is recommended to:

- ensure, in the development of Rakel G2, that critical societal actors are able communicate in extremely remote areas (see section 3.7.3) *(SHK 2026:017 R7)*

SOS Alarm Sverige AB is recommended to:

- review its procedures for following up on alarm plans to ensure that the correct resources reach the accident site (see section 3.7.1) *(SHK 2026:07 R8)*

SHK requests to be informed **no later than 4 September 2026** of the measures that have been taken in response to the recommendations set out in the report.

For the Swedish Accident Investigation Authority

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